



Kinetix 6000 Multi-axis Servo Drives

Catalog Numbers

2094-ACxx-Mxx-S, 2094-BCxx-Mxx-S, 2094-AMxx-S, 2094-BMxx-S

2094-ACxx-Mxx, 2094-BCxx-Mxx, 2094-AMxx, 2094-BMxx,

2094-BSP2, 2094-PRF



Important User Information

Solid-state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication [SGI-1.1](#) available from your local Rockwell Automation sales office or online at <http://www.rockwellautomation.com/literature/>) describes some important differences between solid-state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid-state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.



WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.



ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence



SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.



BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.

IMPORTANT

Identifies information that is critical for successful application and understanding of the product.

Allen-Bradley, CompactLogix, ControlFLASH, ControlLogix, Guardmaster, DriveExplorer, Kinetix, LDC-Series, LDL-Series, MP-Series, RSLinx, RSLogix 5000, SoftLogix, SCANport, RDD-Series, Rockwell Automation, Rockwell Software, TechConnect, and TL-Series are trademarks of Rockwell Automation, Inc.

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This manual contains new and updated information.

New and Updated Information

This revision includes peak-enhancement drive specifications for series B catalog numbers 2094-BC04-M03-S, 2094-BM03-S, 2094-BC07-M05-S, and 2094-BM05-S.

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About This Publication

This manual provides detailed installation instructions for mounting, wiring, and troubleshooting the Kinetix 6000 drives; and system integration for your drive/motor/actuator combination with a Logix controller.

For information on wiring and troubleshooting your Kinetix 6000 servo drive with the safe-off feature, refer to the Kinetix Safe-off Feature Safety Reference Manual, publication [GMC-RM002](#).

Who Should Use This Manual

This manual is intended for engineers or technicians directly involved in the installation and wiring of the Kinetix 6000 drives; and programmers directly involved in the operation, field maintenance, and integration of these drives with a SERCOS interface module.

If you do not have a basic understanding of the Kinetix 6000 drives, contact your local Rockwell Automation sales representative for information on available training courses.

Conventions Used in This Manual

The conventions starting below are used throughout this manual.

- Bulleted lists such as this one provide information, not procedural steps.
- Numbered lists provide sequential steps or hierarchical information.
- Acronyms for the Kinetix 6000 drive components are shown in the table below and are used throughout this manual.

Kinetix 6000 Drive Component	Cat. No.	Acronym
Integrated Axis Module	2094- <i>x</i> C <i>xx</i> -M <i>xx</i> - <i>x</i>	IAM
Axis Module	2094- <i>x</i> M <i>xx</i> - <i>x</i>	AM
Line Interface Module	2094- <i>x</i> L <i>xx</i> and 2094- <i>x</i> L <i>xx</i> S- <i>xx</i>	LIM
Resistive Brake Module	2090-XB <i>xx</i> - <i>xx</i>	RBM

IMPORTANT Throughout this publication, when the IAM or AM module catalog number is followed by -*x*, for example 2094-BMP5-*x*, the variable (*x*) indicates that the drive module may or may not include the safe-off feature.

Additional Resources

These documents contain additional information concerning related Rockwell Automation products.

Resource	Description
Kinetix 6000 Power Rail Installation Instructions, publication 2094-IN003	Information on the installation of your Bulletin 2094 power rail.
Kinetix 6000 Shunt Module Installation Instructions, publication 2094-IN004	Information on the installation of your Bulletin 2094 shunt module.
Line Interface Module Installation Instructions, publication 2094-IN005	Information on the installation and troubleshooting of Bulletin 2094 line interface modules (LIM).
Slot-filler Module Installation Instructions, publication 2094-IN006	Information on the installation of Bulletin 2094 slot-filler module.
2094 Mounting Bracket Installation Instructions, publication 2094-IN008	Information on the installation of Bulletin 2094 mounting brackets.
Resistive Brake Module Installation Instructions, publication 2090-IN009	Information on the installation and wiring of Bulletin 2090 Resistive Brake Modules.
Fiber-optic Cable Installation and Handling Instructions, publication 2090-IN010	Information on proper handling, installing, testing, and troubleshooting fiber-optic cables.
External Shunt Modules Installation Instructions, publication 2090-IN004	Information on mounting and wiring the Bulletin 1394 shunt modules with Bulletin 2094 servo drive systems.
1336 Chopper Module Installation Instructions, publication 1336-5.65	Information on installing, configuring, and calculating the data needed to select a 1336 chopper module and external resistor.
System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001	Information, examples, and techniques designed to minimize system failures caused by electrical noise.
EMC Noise Management DVD, publication GMC-SP004	
Kinetix Safe-off Feature Safety Reference Manual, publication GMC-RM002	Information on wiring and troubleshooting your Kinetix 6000 servo drives with the safe-off feature.
Kinetix Motion Control Selection Guide, publication GMC-SG001	Specifications, motor/servo-drive system combinations, and accessories for Kinetix motion control products.
Rockwell Automation Configuration and Selection Tools website http://www.rockwellautomation.com/en/e-tools	Motion Analyzer application analysis software for drive/motor sizing.
	Online product selection and system configuration tools, including AutoCAD (DXF) drawings.
Rockwell Automation Product Certification, website http://www.rockwellautomation.com/products/certification	For declarations of conformity (DoC) currently available from Rockwell Automation.
SERCOS and Analog Motion Configuration User Manual, publication MOTION-UM001	Information on configuring and troubleshooting your ControlLogix, CompactLogix, and SoftLogix SERCOS interface modules.
Motion Coordinate System User Manual, publication MOTION-UM002	Information to create a motion coordinate system with SERCOS or analog motion modules.
SoftLogix Motion Card Setup and Configuration Manual, publication 1784-UM003	Information on configuring and troubleshooting SoftLogix PCI cards.
ControlFLASH Firmware Upgrade Kit User Manual, publication 1756-QS105	For ControlFLASH information not specific to any drive family.
National Electrical Code, published by the National Fire Protection Association of Boston, MA	An article on wire sizes and types for grounding electrical equipment.
Rockwell Automation Industrial Automation Glossary, publication AG-7.1	A glossary of industrial automation terms and abbreviations.

You can view or download publications at <http://www.rockwellautomation.com/literature>. To order paper copies of technical documentation, contact your local Rockwell Automation distributor or sales representative.

Start

Introduction

Use this chapter to become familiar with the design and installation requirements for Kinetix 6000 drive systems.

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IAM/AM Module Series Change

The peak current ratings of the Kinetix 6000 AM modules (series A and B) are configured at the factory as 150% of continuous current. You can program 460V (series B) AM modules and the equivalent IAM (inverter) modules, for up to 250% of continuous inverter current.

Table 1 - Kinetix 6000 Series Change

IAM Module Cat. No.	AM Module Cat. No.	Peak Current Rating	
		Series A (inverter)	Series B (inverter)
2094-BC01-MP5-S	2094-BMP5-S	150%	250%
2094-BC01-M01-S	2094-BM01-S	150%	250%
2094-BC02-M02-S	2094-BM02-S	150%	250%
2094-BC04-M03-S	2094-BM03-S	150%	250%
2094-BC07-M05-S	2094-BM05-S	150%	200%

IMPORTANT Before your drive will deliver enhanced peak performance, you must enable the peak enhancement feature by configuring your drive by using DriveExplorer or RSLogix 5000 software.

Refer to the interactive Peak Enhancement Configuration Utility to recalculate torque and accel/decel limit values, and paste them into the appropriate Axis Properties dialog box. To download the utility, go to <http://www.ab.com/motion/software/peak.html>.

For more information on setting axis properties in RSLogix 5000 software, refer to [Configure Axis Properties](#) on [page 142](#).

About the Kinetix 6000 Drive Systems

The Kinetix 6000 multi-axis servo drives are designed to provide a Kinetix Integrated Motion solution for your drive/motor/actuator applications.

Table 2 - Kinetix 6000 Drive System Overview

System Component	Cat. No.	Description
Integrated Axis Module	2094-xCxx-Mxx-S ^{(1) (2)}	Integrated Axis Modules (IAM) with the safe-off feature are available with 230V or 460V AC input power and contains an inverter and converter section. The peak enhancement feature is available on 460V (series B) IAM modules.
	2094-xCxx-Mxx	Integrated Axis Modules (IAM), available with 230V or 460V AC input power (does not include the safe-off or peak-enhanced feature), contains an inverter and converter section.
Axis Module	2094-xMxx-S ^{(1) (2)}	Axis Modules (AM) with the safe-off feature are a shared DC-bus inverter rated for 230V or 460V input power. The AM module must be used with an IAM module. The peak enhancement feature is available on 460V (series B) AM modules.
	2094-xMxx	Axis Modules (AM) are a shared DC-bus inverter rated for 230V or 460V input power (does not include the safe-off or peak-enhanced feature). The AM module must be used with an IAM module.
Shunt Module	2094-BSP2	The Bulletin 2094 shunt module mounts to the power rail and provides additional shunting capability in regenerative applications.
Power Rail	2094-PRSx 2094-PRx	The Bulletin 2094 power rail consists of copper bus bars and a circuit board with connectors for each module. The power rail provides power and control signals from the converter section to adjacent inverters. The IAM and AM power modules, shunt module, slot-filler modules mount to the power rail.
Power Rail Slot-filler Module	2094-PRF	The Bulletin 2094 slot-filler module is used when one or more slots on the power rail are empty after all the other power rail modules are installed. One slot-filler module is required for each empty slot.
Logix Controller Platform	1756-MxxSE module 1768-M04SE module 1784-PM16SE PCI card	The SERCOS interface module/PCI card serves as a link between the ControlLogix/CompactLogix/SoftLogix platform and the Kinetix 6000 drive system. The communication link uses the IEC 61491 SSerial Real-time COmmunication System (SERCOS) protocol over a fiber-optic cable.
RSLogix 5000 Software	9324-RLD300ENE	RSLogix 5000 software provides support for programming, commissioning, and maintaining the Logix family of controllers.
Rotary Servo Motors	MP-Series, TL-Series, RDD-Series, 1326AB, F-Series	Compatible rotary motors include the MP-Series (Bulletin MPL, MPM, MPF, and MPS) 230 and 460V motors; RDD-Series; TL-Series; 1326AB (M2L/S2L) and 1326AB (resolver); and F-Series motors.
Linear Motors	LDC-Series, LDL-Series	Compatible motors include LDC-Series iron core (230/460V) and LDL-Series ironless (230V) linear motors.
Linear Actuators	MP-Series	Compatible actuators include MP-Series (230/460V) Bulletin MPAS single-axis and Bulletin MPMA multi-axis integrated linear stages, and MP-Series (230/460V) Bulletin MPAR and MPAL electric cylinders.
Cables	Motor Power, Feedback, and Brake cables	Bulletin 2090 motor power/brake and feedback cables are available with bayonet, threaded, and SpeedTec connectors. Power/brake cables have flying leads on the drive end and straight connectors that connect to servo motors. Feedback cables have flying leads that wire to low-profile connector kits on the drive end and straight connectors on the motor end.
	Communication	Bulletin 2090 SERCOS fiber-optic cables are available as enclosure only, PVC, nylon, and glass with connectors at both ends.
AC Line Filters	2090-XXLF-xxxx	Bulletin 2090-XXLF-xxxx three-phase AC line filters are required to meet CE and available for use in all Kinetix 6000 (230V and 460V) drive systems.
Line Interface Modules	2094-xLxx 2094-xLxxS 2094-XL75S-Cx	Line interface modules (LIM) include the circuit breakers, AC line filter (catalog numbers 2094-AL09 and 2094-BL02 only), power supplies, and safety contactor required for Kinetix 6000 operation. The LIM module does not mount to the power rail. You can purchase individual components separately in place of the LIM module.
External Shunt Modules	1394-SRxxxx	You can use Bulletin 1394 external passive shunt modules when the IAM/AM power module internal shunt and power rail mounted 2094-BSP2 shunt module capability is exceeded.
	1336-Wxxxx	You can use Bulletin 1336 external active shunt modules when the IAM/AM power module internal shunt resistor capability is exceeded. Bulletin 1336-Wxxxx chopper modules require an external resistor.
Resistive Brake Module	2090-XBxx-xx	Resistive Brake Modules (RBM) include a safety contactor for use in a control circuit. Contactors and resistors reside in this module such that the motor leads can be disconnected from the drive with the permanent magnet motor brought to an immediate stop. This module does not mount to the power rail.

(1) Refer to the Kinetix Safe-off Feature Safety Reference Manual, publication [GMC-RM002](#), for more information.

(2) Refer to [Peak Enhancement Specifications](#) on [page 69](#) for more information on drive performance in the Peak-enhanced mode.

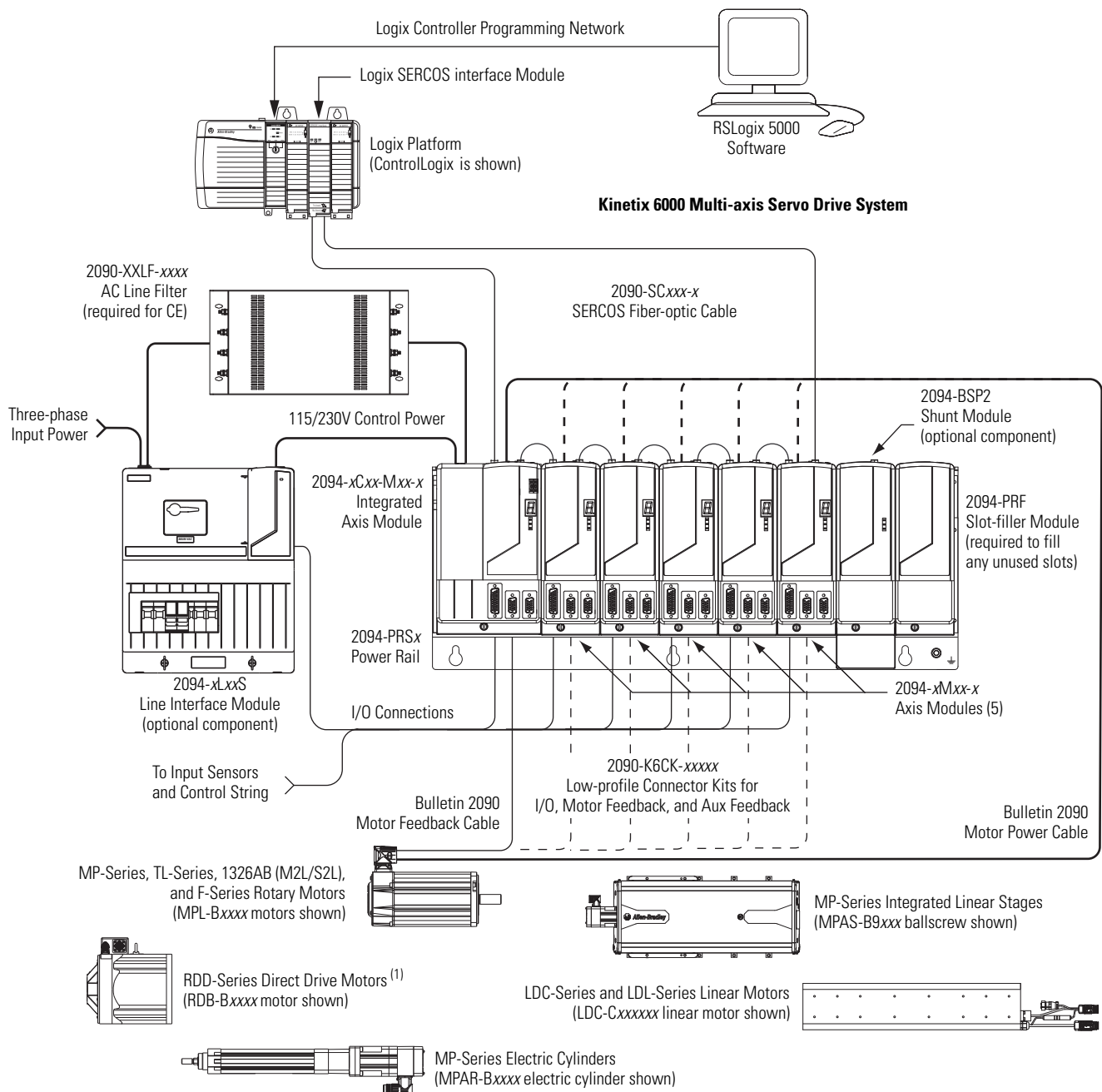
Typical Hardware Configurations

Typical Kinetix 6000 system installations include three-phase AC configurations, with and without the line interface module (LIM), and DC common-bus configurations.



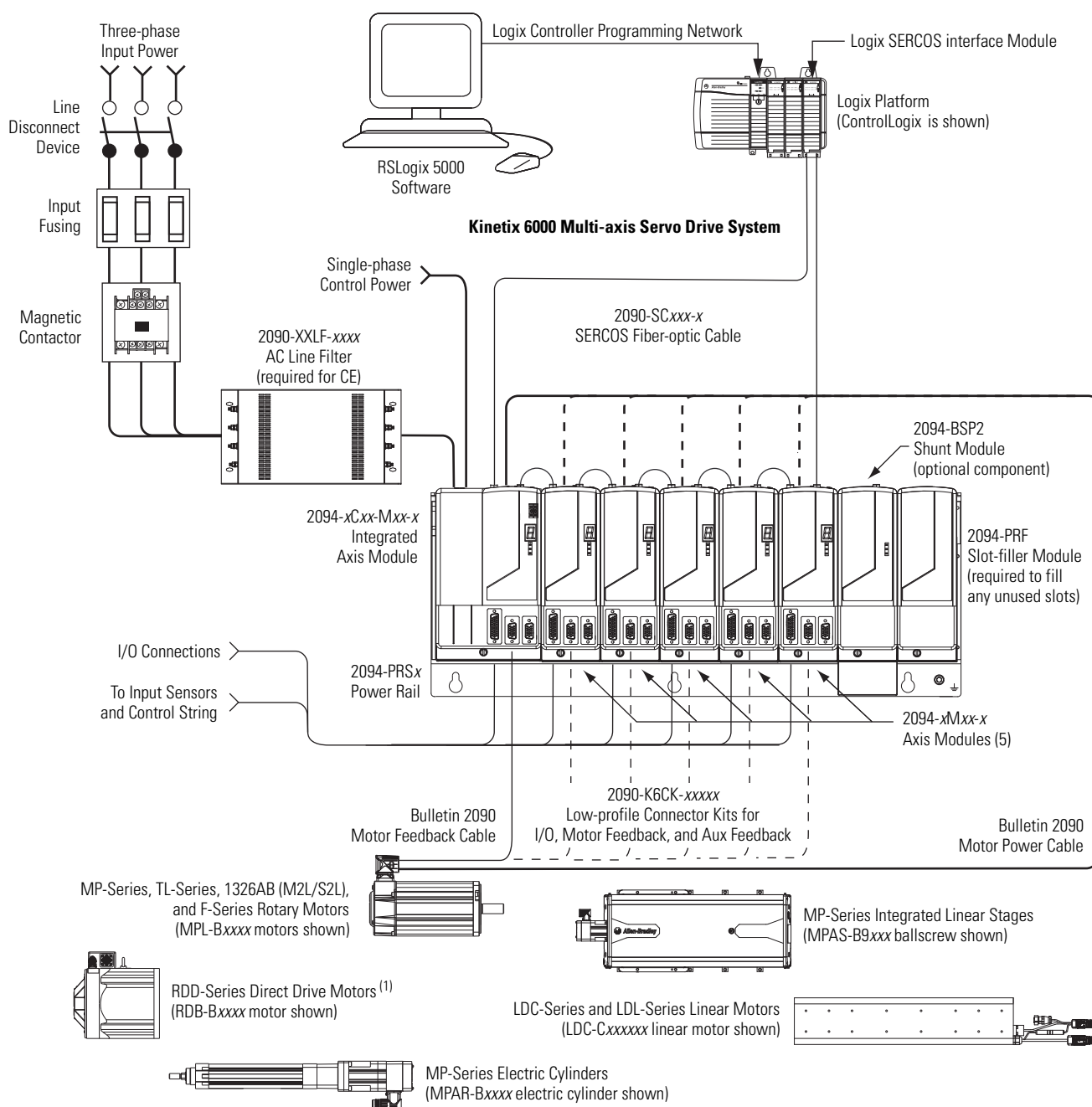
SHOCK HAZARD: To avoid personal injury due to electrical shock, place a 2094-PRF slot-filler module in all empty slots on the power rail. Any power rail connector without a module installed will disable the Kinetix 6000 three-phase power; however, control power is still present.

Figure 1 - Typical Kinetix 6000 System Installation (with LIM)

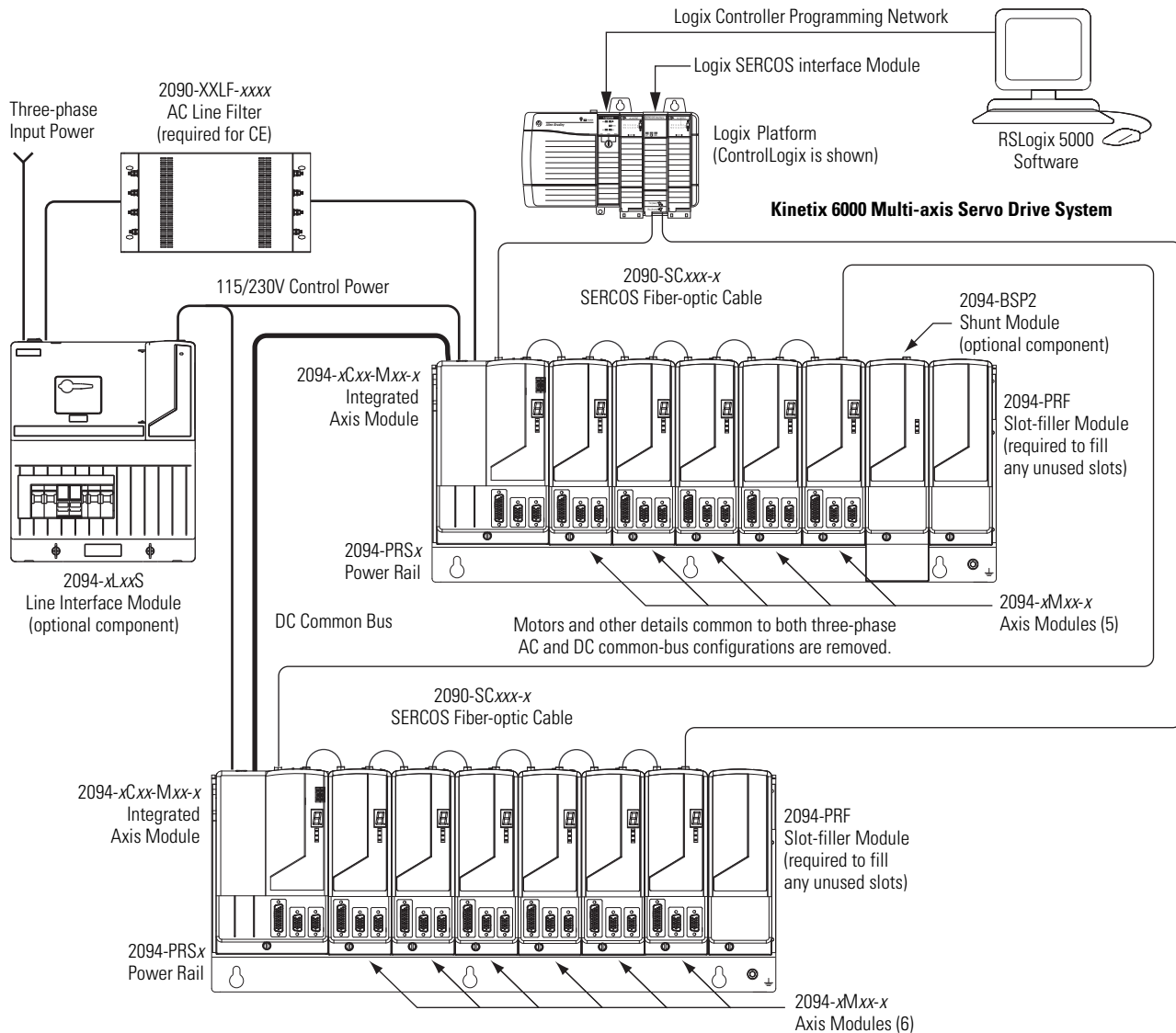


(1) RDD-Series direct-drive motors require the 2090-K6CK-KENDAT low-profile feedback module.

Figure 2 - Typical Kinetix 6000 System Installation (without LIM)



(1) RDD-Series direct-drive motors require the 2090-K6CK-KENDAT low-profile feedback module.

Figure 3 - Typical DC Common Bus System Installation

In the example above, the leader IAM module is connected to the follower IAM module via the DC common-bus. When planning your panel layout, you must calculate the total bus capacitance of your DC common-bus system to be sure that the leader IAM module is sized sufficiently to pre-charge the entire system.

Refer to [Appendix D](#), beginning on [page 245](#), for more information.

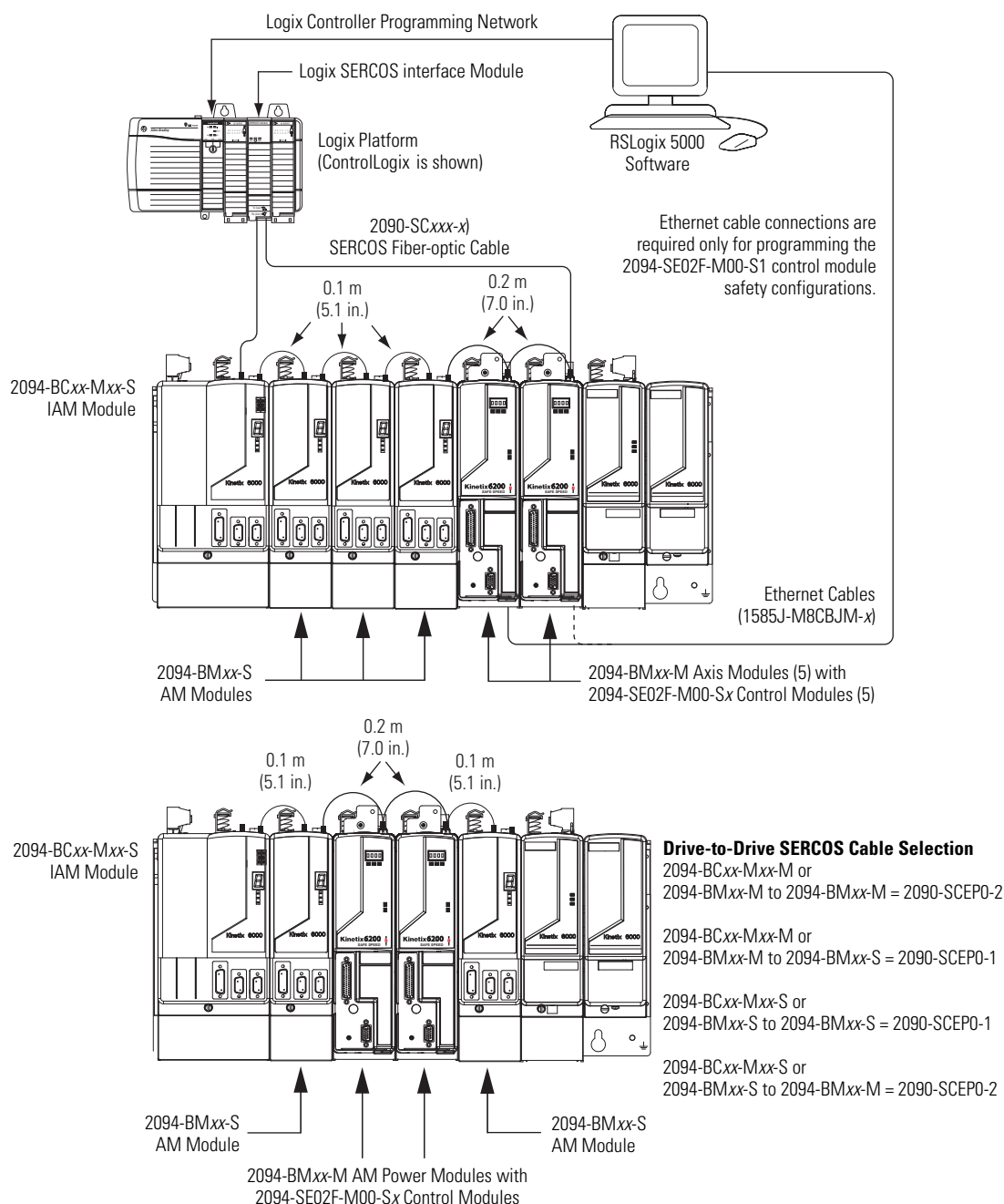
IMPORTANT If total bus capacitance of your system exceeds the leader IAM module pre-charge rating and input power is applied, the IAM module seven-segment status indicator will display error code E90 (pre-charge timeout fault). To correct this condition, you must replace the leader IAM module with a larger module or decrease the total bus capacitance by removing AM modules.

Typical Communication Configurations

In this example, drive-to-drive SERCOS cables and catalog numbers are shown when Kinetix 6000 and Kinetix 6200 drive modules exist on the same power rail.

The Kinetix 6200 control modules use SERCOS interface for configuring the Logix module and the EtherNet/IP network for diagnostics and configuring safety functions. An Ethernet cable is connected to each control module during safety configuration.

Figure 4 - Typical Kinetix 6000 and Kinetix 6200 Communication (SERCOS)



Catalog Number Explanation

Kinetix 6000 (Bulletin 2094) drive catalog numbers and descriptions are listed in the tables below.

IMPORTANT Throughout this publication, when the IAM or AM module catalog number is followed by -x, for example 2094-BMP5-x, the variable (x) indicates that the drive module may or may not include the safe-off feature.

Table 3 - Kinetix 6000 Drive Catalog Numbers

Integrated Axis Modules (230V)	Cat. No. (with safe-off feature)	Cat. No. (without safe-off feature)
Kinetix 6000, IAM, 230V, 3 kW converter, 5 A inverter	2094-AC05-MP5-S	2094-AC05-MP5
Kinetix 6000, IAM, 230V, 3 kW converter, 9 A inverter	2094-AC05-M01-S	2094-AC05-M01
Kinetix 6000, IAM, 230V, 6 kW converter, 15 A inverter	2094-AC09-M02-S	2094-AC09-M02
Kinetix 6000, IAM, 230V, 11 kW converter, 24 A inverter	2094-AC16-M03-S	2094-AC16-M03
Kinetix 6000, IAM, 230V, 23 kW converter, 49 A inverter	2094-AC32-M05-S	2094-AC32-M05
Integrated Axis Modules (460V)		
Kinetix 6000, IAM, 460V, 6 kW converter, 4 A inverter	2094-BC01-MP5-S ⁽¹⁾	2094-BC01-MP5
Kinetix 6000, IAM, 460V, 6 kW converter, 9 A inverter	2094-BC01-M01-S ⁽¹⁾	2094-BC01-M01
Kinetix 6000, IAM, 460V, 15 kW converter, 15 A inverter	2094-BC02-M02-S ⁽¹⁾	2094-BC02-M02
Kinetix 6000, IAM, 460V, 28 kW converter, 30 A inverter	2094-BC04-M03-S ⁽¹⁾	2094-BC04-M03
Kinetix 6000, IAM, 460V, 45 kW converter, 49 A inverter	2094-BC07-M05-S ⁽²⁾	2094-BC07-M05
Axis Modules (230V)		
Kinetix 6000, AM, 230V, 5 A	2094-AMP5-S	2094-AMP5
Kinetix 6000, AM, 230V, 9 A	2094-AM01-S	2094-AM01
Kinetix 6000, AM, 230V, 15 A	2094-AM02-S	2094-AM02
Kinetix 6000, AM, 230V, 24 A	2094-AM03-S	2094-AM03
Kinetix 6000, AM, 230V, 49 A	2094-AM05-S	2094-AM05
Axis Modules (460V)		
Kinetix 6000, AM, 460V, 4 A	2094-BMP5-S ⁽¹⁾	2094-BMP5
Kinetix 6000, AM, 460V, 9 A	2094-BM01-S ⁽¹⁾	2094-BM01
Kinetix 6000, AM, 460V, 15 A	2094-BM02-S ⁽¹⁾	2094-BM02
Kinetix 6000, AM, 460V, 30 A	2094-BM03-S ⁽¹⁾	2094-BM03
Kinetix 6000, AM, 460V, 49 A	2094-BM05-S ⁽²⁾	2094-BM05

(1) You can configure the peak inverter current rating of this 460V (series B) IAM or AM module for 250% of continuous inverter current.

(2) You can configure the peak inverter current rating of this 460V (series B) IAM or AM module for 200% of continuous inverter current. Refer to [Peak Enhancement Specifications](#) on [page 69](#), for more information on drive performance in the peak-enhanced mode.

Table 4 - Kinetix 6000 Drive Component Catalog Numbers

Drive Components	Cat. No.
Kinetix 6000 shunt module, 230/460V, 200 W	2094-BSP2
Kinetix 6000 slot-filler module, 230/460V	2094-PRF

Drive Component Compatibility

The 2094-BC $_{xx}$ -M $_{xx}$ -M and 2094-BM $_{xx}$ -M power modules contain the same power structure as the 2094-BC $_{xx}$ -M $_{xx}$ -S and 2094-BM $_{xx}$ -S drive modules. Because of this, the 2094-BSP2 shunt module, 2094-PRF slot-filler module, and 2094-PR $_{Sx}$ power rails are supported by both drive families.

In addition, 2094-BM $_{xx}$ -M AM power modules with SERCOS interface are supported on power rails with a 2094-BC $_{xx}$ -M $_{xx}$ -S IAM drive module. Conversely, 2094-BM $_{xx}$ -S AM drive modules are supported on power rails with a 2094-BC $_{xx}$ -M $_{xx}$ -M IAM power module with SERCOS interface.

IMPORTANT Kinetix 6500 EtherNet/IP control modules (catalog numbers 2094-EN02D-M01-S $_{x}$) are not compatible with IAM/AM modules on the same Bulletin 2094 power rail with Kinetix 6000 or Kinetix 6200 SERCOS drives.

Table 5 - IAM and AM Module/Network Compatibility

IAM Module	Control Module	2094-xM $_{xx}$ -S Kinetix 6000 AM Module	2094-BM $_{xx}$ -M AM Power Modules	
			2094-SE02F-M00-S $_{x}$ Kinetix 6200 Control Module	2094-EN02D-M01-S $_{x}$ Kinetix 6500 Control Module
2094-xC $_{xx}$ -M $_{xx}$ -S	N/A	Fully compatible	Fully compatible	Not compatible
2094-BC $_{xx}$ -M $_{xx}$ -M (IAM power module)	2094-SE02F-M00-S $_{x}$ SERCOS interface			
	2094-EN02D-M01-S $_{x}$ EtherNet/IP network	Not compatible	Not compatible	Fully compatible

For additional information on the 2094-BC $_{xx}$ -M $_{xx}$ -M (IAM) and 2094-BM $_{xx}$ -M (AM) modules, refer to the Kinetix 6200 and Kinetix 6500 Multi-axis Servo Drives User Manual, publication [2094-UM002](#).

Agency Compliance

If this product is installed within the European Union and has the CE mark, the following regulations apply.



ATTENTION: Meeting CE requires a grounded system, and the method of grounding the AC line filter and drive must match. Failure to do this renders the filter ineffective and may cause damage to the filter. For grounding examples, refer to Grounded Power Configurations on [page 79](#).

For more information on electrical noise reduction, refer to the System Design for Control of Electrical Noise Reference Manual, publication [GMC-RM001](#).

CE Requirements (system without LIM module)

To meet CE requirements when your Kinetix 6000 system does not include the LIM module, these requirements apply.

- Install an AC line filter (catalog number 2090-XXLF-xxxx) as close to the IAM module as possible.
- Use 2090 series motor power cables or use connector kits and terminate the cable shields to the chassis clamp provided.
- Combined motor power cable length for all axes on the same DC bus must not exceed 240 m (787 ft) with 460V systems or 160 m (525 ft) with 230V systems. Drive-to-motor power cables must not exceed 90 m (295.5 ft).
- Use 2090 series motor feedback cables or use connector kits and properly terminate the feedback cable shield. Drive-to-motor feedback cables must not exceed 90 m (295.5 ft).
- Install the Kinetix 6000 system inside an enclosure. Run input power wiring in conduit (grounded to the enclosure) outside of the enclosure. Separate signal and power cables.

Refer to Appendix B on [page 199](#) for interconnect diagrams, including input power wiring and drive/motor interconnect diagrams.

CE Requirements (system with LIM module)

To meet CE requirements when your Kinetix 6000 system includes the LIM module, follow all the requirements as stated in CE Requirements (system without LIM module) and these additional requirements as they apply to the AC line filter.

- Install the LIM module (catalog numbers 2094-AL09 or 2094-BL02) as close to the IAM module as possible.
- Install the LIM module (catalog numbers 2094-ALxxS, 2094-BLxxS, or 2094-XL75S-Cx) with line filter (catalog number 2090-XXLF-xxxx) as close to the IAM module as possible.

When the LIM module (catalog numbers 2094-ALxxS, 2094-BLxxS, or 2094-XL75S-Cx) supports two IAM modules, each IAM module requires an AC line filter installed as close to the IAM module as possible.

Planning the Kinetix 6000 Drive System Installation

Introduction

This chapter describes system installation guidelines used in preparation for mounting your Kinetix 6000 drive components.

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System Design Guidelines	24
Electrical Noise Reduction	31



ATTENTION: Plan the installation of your system so that you can perform all cutting, drilling, tapping, and welding with the system removed from the enclosure. Because the system is of the open type construction, be careful to keep any metal debris from falling into it. Metal debris or other foreign matter can become lodged in the circuitry, which can result in damage to components.

System Design Guidelines

Use the information in this section when designing your enclosure and planning to mount your system components on the panel.

For on-line product selection and system configuration tools, including AutoCAD (DXF) drawings of the product, refer to <http://www.rockwellautomation.com/en/e-tools>.

System Mounting Requirements

- To comply with UL and CE requirements, the Kinetix 6000 drive system must be enclosed in a grounded conductive enclosure offering protection as defined in standard EN 60529 (IEC 529) to IP2X such that they are not accessible to an operator or unskilled person. A NEMA 4X enclosure exceeds these requirements providing protection to IP66.
- The panel you install inside the enclosure for mounting your system components must be on a flat, rigid, vertical surface that won't be subjected to shock, vibration, moisture, oil mist, dust, or corrosive vapors.
- Size the drive enclosure so as not to exceed the maximum ambient temperature rating. Consider heat dissipation specifications for all drive components.
- Combined motor power cable length for all axes on the same DC bus must not exceed 240 m (787 ft) with 460V systems or 160 m (525 ft) with 230V systems. Drive-to-motor power cables must not exceed 90 m (295.5 ft).

IMPORTANT	System performance was tested at these cable length specifications. These limitations also apply when meeting CE requirements.
------------------	--

- Segregate input power wiring and motor power cables from control wiring and motor feedback cables. Use shielded cable for power wiring and provide a grounded 360° clamp termination.
- Use high-frequency (HF) bonding techniques to connect the modules, enclosure, machine frame, and motor housing, and to provide a low-impedance return path for high-frequency (HF) energy and reduce electrical noise.

Refer to the System Design for Control of Electrical Noise Reference Manual, publication [GMC-RM001](#), to better understand the concept of electrical noise reduction.

Transformer Selection

The IAM module does not require an isolation transformer for three-phase input power. However, a transformer may be required to match the voltage requirements of the controller to the available service.

To size a transformer for the main AC power inputs, refer to Circuit Breaker/Fuse Specifications on [page 187](#) and Transformer Specifications for Control Power Input on [page 188](#).

IMPORTANT	If using an autotransformer, make sure that the phase to neutral/ground voltages do not exceed the input voltage ratings of the drive.
------------------	--

IMPORTANT	Use a form factor of 1.5 for three-phase power (where form factor is used to compensate for transformer, drive module, and motor losses, and to account for utilization in the intermittent operating area of the torque speed curve).
------------------	--

Example: Sizing a transformer to the voltage requirements of a 2094-BC01-M01-S Integrated Axis Module:
 $2094\text{-BC01-M01-S} = 6 \text{ kW continuous} \times 1.5 = 9.0 \text{ KVA transformer}$

Circuit Breaker/Fuse Selection

The Kinetix 6000 drives use internal solid-state motor short-circuit protection and, when protected by suitable branch circuit protection, are rated for use on a circuit capable of delivering up to 200,000 A. Fuses or circuit breakers, with adequate withstand and interrupt ratings, as defined in NEC or applicable local codes, are permitted.

The 2094-AL09 and 2094-BL02 LIM modules contain supplementary protection devices and, when protected by suitable branch circuit protection, are rated for use on a circuit capable of delivering up to 5000 A. When these modules are used, protection on the line side of the LIM module is required. Fuses must be class J or CC only.

The 2094-ALxxS, 2094-BLxxS, and 2094-XL75S-Cx LIM modules contain branch circuit rated devices suitable for use on a circuit capable of delivering up to 65,000 A (460V) or 100,000 A (230V).

Refer to the Line Interface Module Installation Instructions, publication [2094-IN005](#), for power specifications and more information on using the LIM module.

The Bulletin 140M and 140U products are another acceptable means of protection. As with fuses and circuit breakers, you must make sure that the selected components are properly coordinated and meet applicable codes including any requirements for branch circuit protection. When applying the 140M/140U product, evaluation of the short circuit available current is critical and must be kept below the short circuit current rating of the 140M/140U product.

In most cases, class CC, J, L, and R fuses selected to match the drive input current rating will meet the NEC requirements or applicable local codes, and provide the full drive capabilities. Dual element, time delay (slow-acting) fuses should be used to avoid nuisance trips during the inrush current of power initialization.

Refer to Circuit Breaker/Fuse Specifications on [page 187](#) for recommended circuit breakers and fuses.

Refer to Power Specifications on [page 180](#) for input current and inrush current specifications for your IAM module.

Enclosure Selection

This example is provided to assist you in sizing an enclosure for your Bulletin 2094 drive system. The example system consists of these components:

- 6-axis Bulletin 2094 servo drive system
- Line Interface Module (LIM)
- ControlLogix chassis and modules (controller)

Size the Bulletin 2094 servo drive and LIM module and use the results to predict the amount of heat dissipated into the enclosure. You will also need heat dissipation data from other equipment inside the enclosure (such as the ControlLogix controller). Once the total amount of heat dissipation (in watts) is known, you can calculate the minimum enclosure size.

Table 6 - Bulletin 2094 System Heat Dissipation Example

Enclosure Component	Description		Loading ⁽¹⁾	Heat Dissipation ⁽¹⁾ watts
2094-BC02-M02-x	Integrated axis module (IAM), 400/460V	15 kW (converter section)	20%	44
		15 A (inverter section)	40%	72
2094-BM02-x	Axis module (AM), 400/460V, 15 A		60%	93
2094-BM02-x	Axis module (AM), 400/460V, 15 A		60%	93
2094-BM01-x	Axis module (AM), 400/460V 9 A		40%	73
2094-BM01-x	Axis module (AM), 400/460V, 9 A		40%	73
2094-BM01-x	Axis module (AM), 400/460V, 9 A		20%	57
2094-BL25S	Line interface module (LIM), 400/460V, 25 A; 24V DC 20 A		100%	43
2094-PRS6	Power rail, 460V, 6 axis		N/A	0
2090-XB33-32	Resistive brake module (RBM), 33 A, 32 Ω		N/A	30
Total Kinetix 6000 system wattage				578

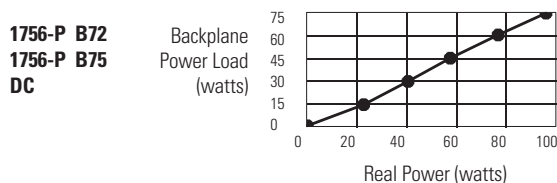
(1) To determine heat dissipation specifications for the drive system components, refer to Power Dissipation Specifications on [page 189](#).

Table 7 - ControlLogix System Heat Dissipation Example

Enclosure Component	Description	Backplane Power Load ⁽¹⁾ watts	Heat Dissipation ⁽¹⁾ watts
1756-M08SE	8-axis SERCOS interface module	3.2	0
1756-L5563	L63 ControlLogix processor	4.5	0
1756-IB16D	16 -point input module	0.84	5.8
1756-OB16D	16 -point output module	4.64	3.3
1756-ENxTx	EtherNet/IP communication module	4.0	0
Backplane total		17.18 ⁽²⁾	N/A
1756-PB72	24V DC ControlLogix power supply	N/A	25 ⁽²⁾
1756-A7	7-slot mounting chassis	N/A	N/A
Total ControlLogix system wattage			34.1

(1) For ControlLogix module specifications, refer to the ControlLogix Selection Guide, publication [1756-SG001](#).

(2) Real power heat dissipation is determined by applying the backplane power load (17.18W) to the graph below.

Figure 5 - ControlLogix Real Power

For backplane power loading requirements of other ControlLogix power supplies, refer to the ControlLogix Selection Guide, publication [1756-SG001](#).

In this example, the amount of power dissipated inside the cabinet is the sum of the Bulletin 2094 system value (578 W) and the ControlLogix system value (34 W) for a total of 612 W.

With no active method of heat dissipation (such as fans or air conditioning) either of these approximate equations can be used.

Metric	Standard English
$A = \frac{0.38Q}{1.8T - 1.1}$	$A = \frac{4.08Q}{T - 1.1}$
Where T is temperature difference between inside air and outside ambient (°C), Q is heat generated in enclosure (Watts), and A is enclosure surface area (m ²). The exterior surface of all six sides of an enclosure is calculated as	Where T is temperature difference between inside air and outside ambient (°F), Q is heat generated in enclosure (Watts), and A is enclosure surface area (ft ²). The exterior surface of all six sides of an enclosure is calculated as
$A = 2dw + 2dh + 2wh$	$A = (2dw + 2dh + 2wh) / 144$
Where d (depth), w (width), and h (height) are in meters.	Where d (depth), w (width), and h (height) are in inches.

Total system watts dissipated (Q) was calculated at 612 W. The maximum ambient rating of the Bulletin 2094 system is 50 °C (122 °F) and if the maximum environmental temperature is 30 °C (86 °F), then $T=20$ in the equation below.

$$A = \frac{0.38 (612)}{1.8 (20) - 1.1} = 6.66 \text{ m}^2$$

In this example, the enclosure must have an exterior surface of 6.66 m². If any portion of the enclosure is not able to transfer heat, it should not be included in the calculation.

Because the minimum cabinet depth to house the 460V drive (selected for this example) is 302 mm (11.9 in.), then the cabinet needs to be approximately 2500 mm (high) x 950 mm (wide) x 302 mm (deep).

$$2 \times (0.3 \times 0.95) + 2 \times (0.3 \times 2.5) + 2 \times (0.95 \times 2.5) = 6.82 \text{ m}^2$$

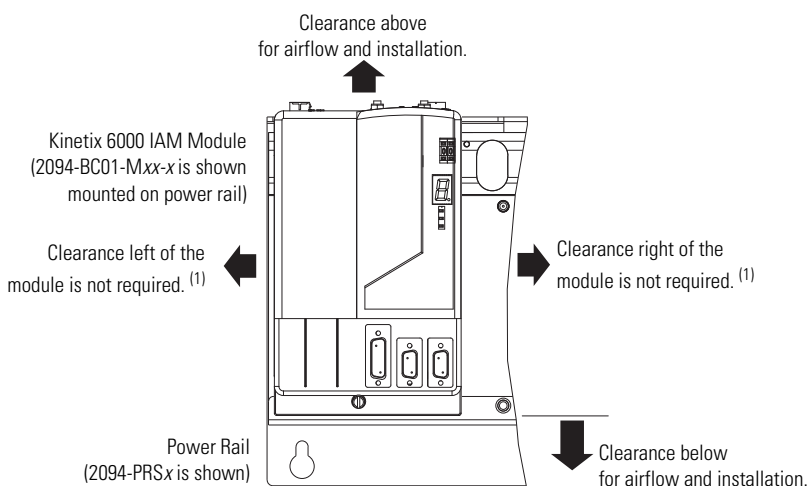
Because this cabinet size is considerably larger than what is necessary to house the system components, it may be more efficient to provide a means of cooling in a smaller cabinet. Contact your cabinet manufacturer for options available to cool your cabinet.

Minimum Clearance Requirements

This section provides information to assist you in sizing your cabinet and positioning your Bulletin 2094 system components.

IMPORTANT Mount the module in an upright position. Do not mount the module on its side.

Figure 6 - Minimum Clearance Requirements



(1) The power rail (slim), catalog number 2094-PRSx, extends left and right of the first and last module 5.0 mm (0.20 in.). The power rail, catalog number 2094-PRx, extends approximately 25.4 mm (1.0 in.) left of the IAM module and right of the last module mounted on the rail.

Table 8 - Minimum Clearance Dimensions

Cat. No.	Clearance Above, Min	Clearance Below, Min	Cabinet Depth Clearance, Min
2094-AC05-Mxx-x, 2094-AC09-M02-x, 2094-AMP5-x, 2094-AM01-x, 2094-AM02-x	50.8 mm (2.0 in.)	50.8 mm (2.0 in.)	198 mm (7.8 in.)
2094-BC01-Mxx-x, 2094-BC02-M02-x, 2094-BMP5-x, 2094-BM01-x, 2094-BM02-x	50.8 mm (2.0 in.)	50.8 mm (2.0 in.)	272 mm (10.7 in.)
2094-BSP2			272 mm (10.7 in.)
2094-AC16-M03-x, 2094-AC32-M05-x, 2094-AM03-x, 2094-AM05-x	305 mm (12.0 in.)	50.8 mm (2.0 in.)	198 mm (7.8 in.)
2094-BC04-M03-x, 2094-BC07-M05-x, 2094-BM03-x, 2094-BM05-x	305 mm (12.0 in.)	50.8 mm (2.0 in.)	272 mm (10.7 in.)

IMPORTANT Although clearance left and right of the power rail is not necessary for ventilation, additional clearance is required when mounted adjacent to noise sensitive equipment or clean wireways.

Refer to [page 189](#) for power dissipation specifications.

Electrical Noise Reduction

This section outlines best practices that minimize the possibility of noise-related failures as they apply specifically to Kinetix 6000 system installations. For more information on the concept of high-frequency (HF) bonding, the ground plane principle, and electrical noise reduction, refer to the System Design for Control of Electrical Noise Reference Manual, publication [GMC-RM001](#).

Bonding Modules

Bonding is the practice of connecting metal chassis, assemblies, frames, shields, and enclosures to reduce the effects of electromagnetic interference (EMI).

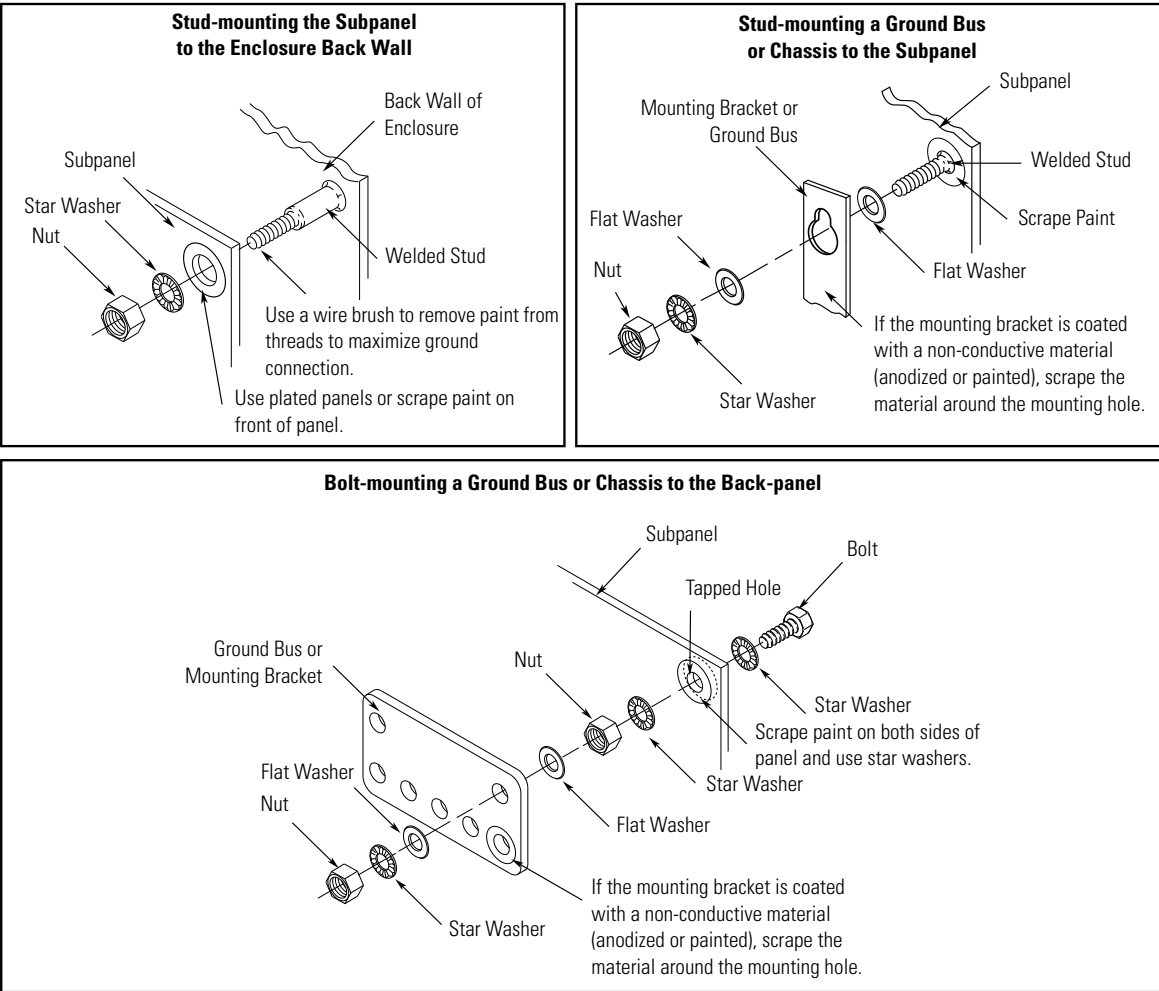
Unless specified, most paints are not conductive and act as insulators. To achieve a good bond between power rail and the subpanel, surfaces need to be paint-free or plated. Bonding metal surfaces creates a low-impedance return path for high-frequency energy.

IMPORTANT To improve the bond between the power rail and subpanel, construct your subpanel out of zinc plated (paint-free) steel.

Improper bonding of metal surfaces blocks the direct return path and allows high-frequency energy to travel elsewhere in the cabinet. Excessive high-frequency energy can effect the operation of other microprocessor controlled equipment.

These illustrations show details of recommended bonding practices for painted panels, enclosures, and mounting brackets.

Figure 7 - Recommended Bonding Practices for Painted Panels

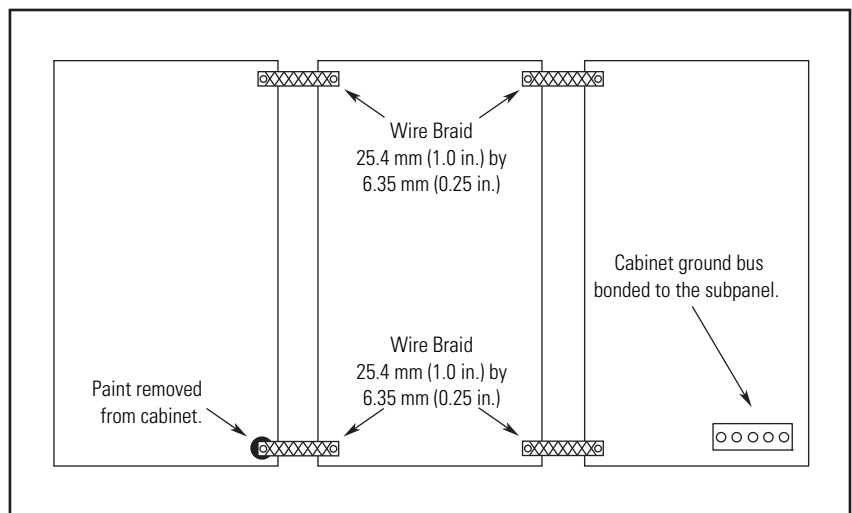


Bonding Multiple Subpanels

Bonding multiple subpanels creates a common low impedance exit path for the high frequency energy inside the cabinet. Subpanels that are not bonded together may not share a common low impedance path. This difference in impedance may affect networks and other devices that span multiple panels.

- Bond the top and bottom of each subpanel to the cabinet by using 25.4 mm (1.0 in.) by 6.35 mm (0.25 in.) wire braid. As a rule, the wider and shorter the braid is, the better the bond.
- Scrape the paint from around each fastener to maximize metal-to-metal contact.

Figure 8 - Multiple Subpanels and Cabinet Recommendations

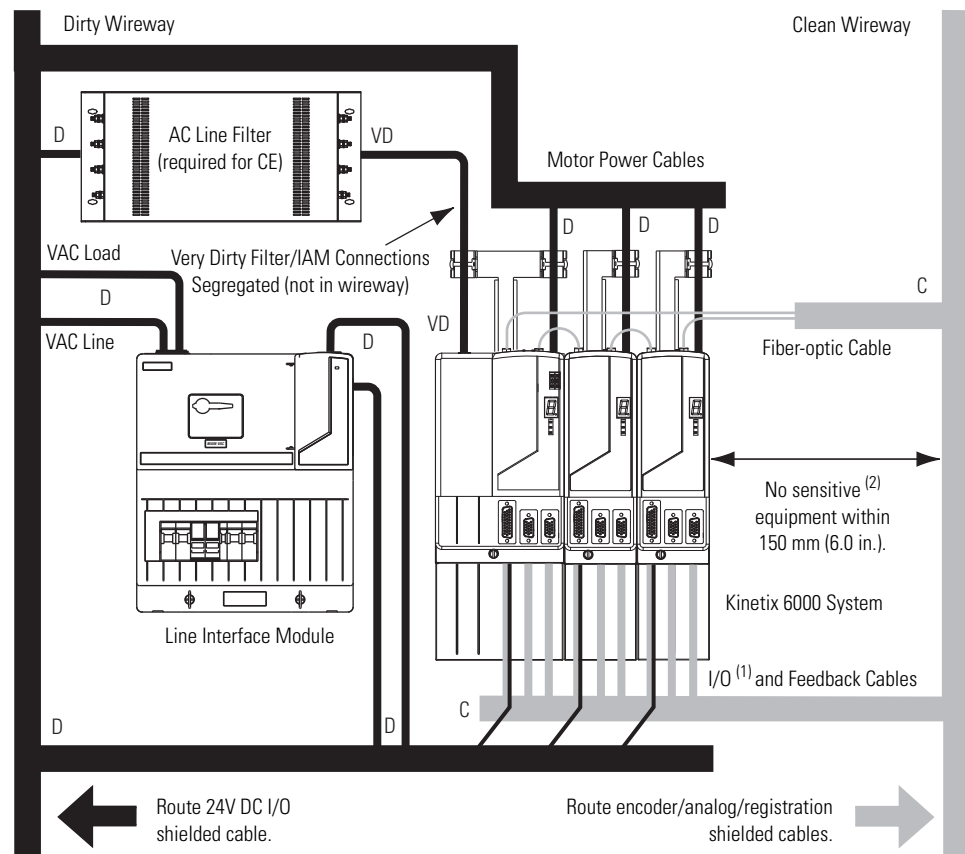


Establishing Noise Zones

Observe these guidelines when the 2094-ALxxS, 2094-BLxxS, or 2094-XL75S-Cx LIM module is used in the Bulletin 2094 system and mounted left of the IAM module with the AC (EMC) line filter mounted above the LIM module:

- The clean zone (C) is to the right and beneath the Bulletin 2094 system (gray wireway).
- The dirty zone (D) is to the left and above the Bulletin 2094 system, and above and below the LIM module (black wireway).
- The very dirty zone (VD) is from the filter output to IAM module. Shielded cable is required on the EMC filter (load side) and the braided shield attached to the clamp provided.
- The SERCOS fiber-optic cables are immune to electrical noise, but due to their delicate nature, route them in the clean zone.

Figure 9 - Noise Zones (LIM mounted left of IAM module)



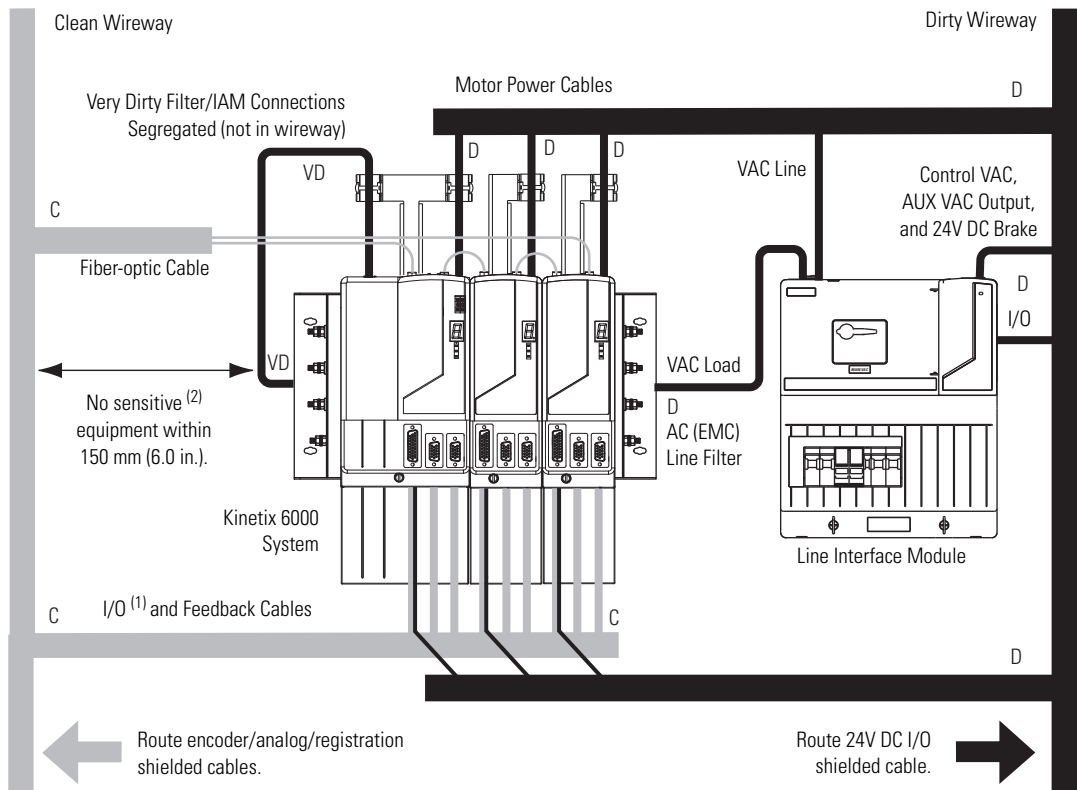
(1) If drive system I/O cable contains (dirty) relay wires, route cable with LIM module I/O cable in dirty wireway.

(2) When space does not permit the 150 mm (6.0 in.) segregation, use a grounded steel shield instead. For examples, refer to the System Design for Control of Electrical Noise Reference Manual, publication [GMC-RM001](#).

Observe these guidelines when the 2094-ALxxS, 2094-BLxxS, or 2094-XL75S-Cx LIM module is used in the Bulletin 2094 system and mounted right of the IAM module with the AC (EMC) line filter mounted behind the IAM module:

- The clean zone (C) is to the left and beneath the Bulletin 2094 system (gray wireway).
- The dirty zone (D) is to the right and above the Bulletin 2094 system, and above and below the LIM module (black wireway).
- The very dirty zone (VD) is from the filter output to IAM module. Shielded cable is required on the EMC filter (load side) and the braided shield attached to the clamp provided.
- The SERCOS fiber-optic cables are immune to electrical noise, but due to their delicate nature, route them in the clean zone.

Figure 10 - Noise Zones (LIM with EMC filter behind IAM module)



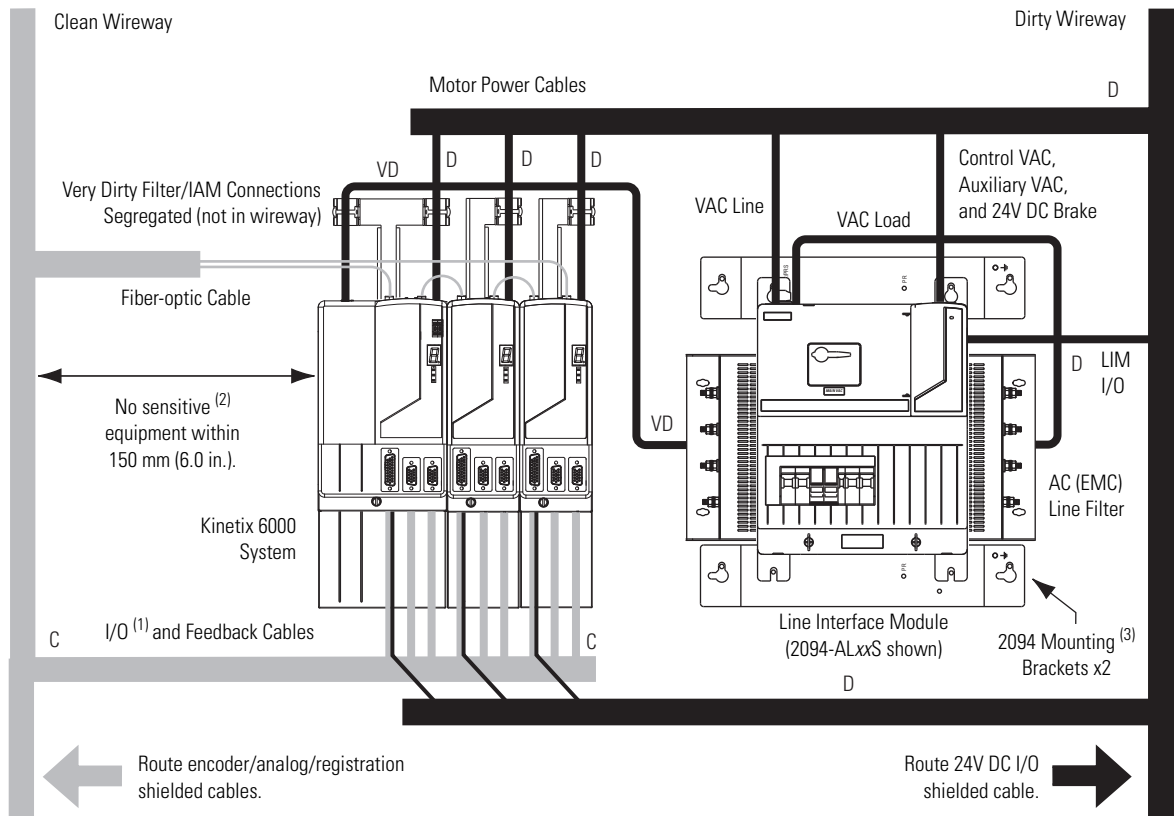
(1) If drive system I/O cable contains (dirty) relay wires, route cable with LIM module I/O cable in dirty wireway.

(2) When space does not permit the 150 mm (6.0 in.) segregation, use a grounded steel shield instead. For examples, refer to the System Design for Control of Electrical Noise Reference Manual, publication [GMC-RM001](#).

Observe these guidelines when the 2094-ALxxS, 2094-BLxxS, or 2094-XL75S-Cx LIM module is used in the Bulletin 2094 system and mounted right of the drive with the AC (EMC) line filter mounted behind the LIM module:

- The clean zone (C) is to the left and beneath the Bulletin 2094 system (gray wireway).
- The dirty zone (D) is to the right and above the Bulletin 2094 system, and above and below the LIM module (black wireway).
- The very dirty zone (VD) is from the filter output to drive. Shielded cable is required on the EMC filter (load side) and the braided shield attached to the clamp (when provided).
- The SERCOS fiber-optic cables are immune to electrical noise, but due to their delicate nature, route them in the clean zone.

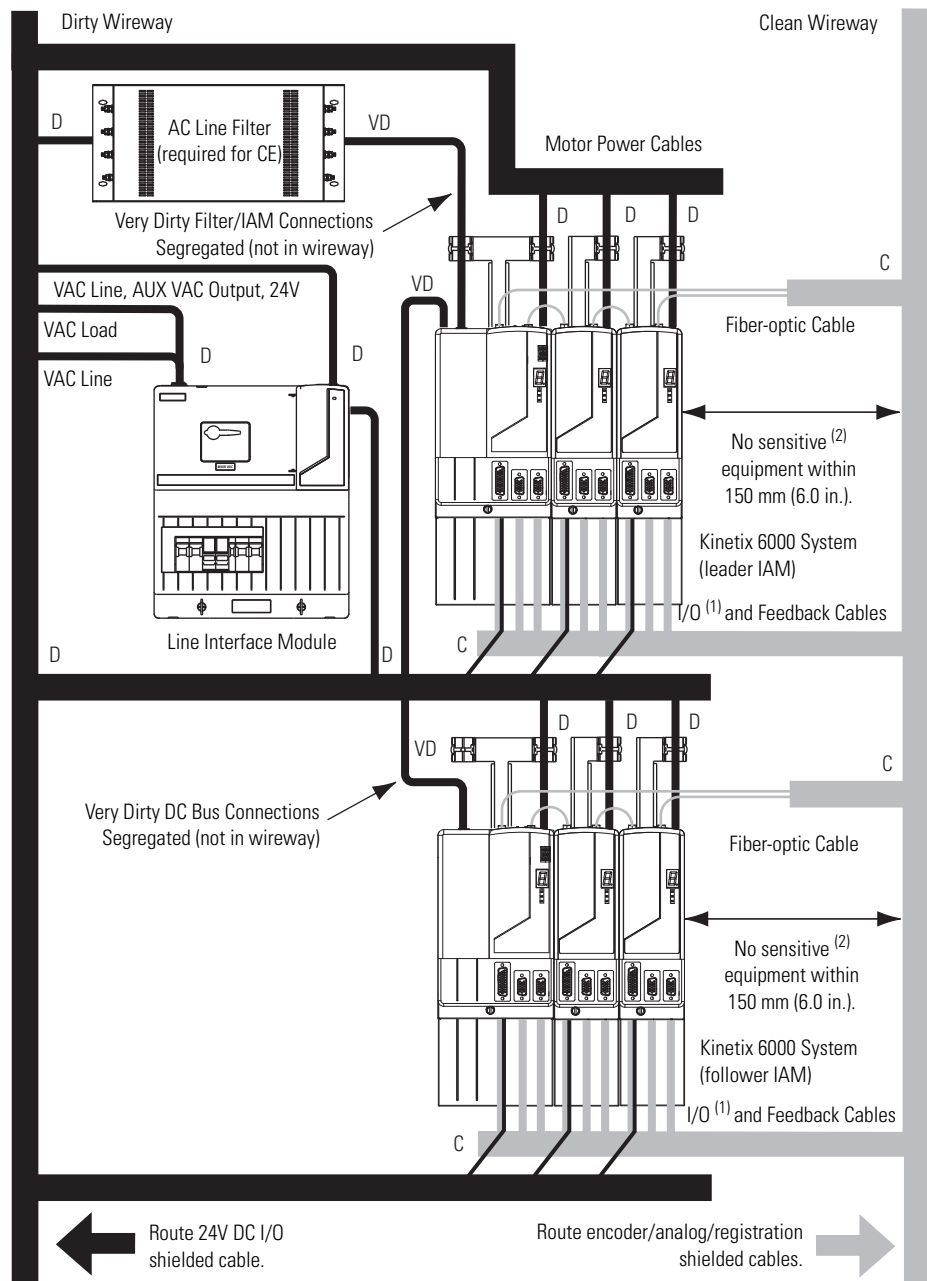
Figure 11 - Noise Zones (EMC filter behind LIM module)



- (1) If drive system I/O cable contains (dirty) relay wires, route cable with LIM module I/O cable in dirty wireway.
- (2) When space does not permit the 150 mm (6.0 in.) segregation, use a grounded steel shield instead. For examples, refer to the System Design for Control of Electrical Noise Reference Manual, publication [GMC-RM001](#).
- (3) Only the 2094-ALxxS and 2094-XL75S-Cx LIM modules are compatible with the 2094 mounting brackets. The 2094-BLxxS, 2094-AL09, and 2094-BL02 LIM modules are not compatible.

Keep the DC common-bus cable (very dirty) segregated from all other cables (not in a wireway) when the 2094-ALxxS, 2094-BLxxS, or 2094-XL75S-Cx LIM module is used in a DC common-bus configuration and the follower IAM module is mounted below the leader IAM module.

Figure 12 - Noise Zones (DC common bus)



(1) If drive system I/O cable contains (dirty) relay wires, route cable with LIM module I/O cable in dirty wireway.

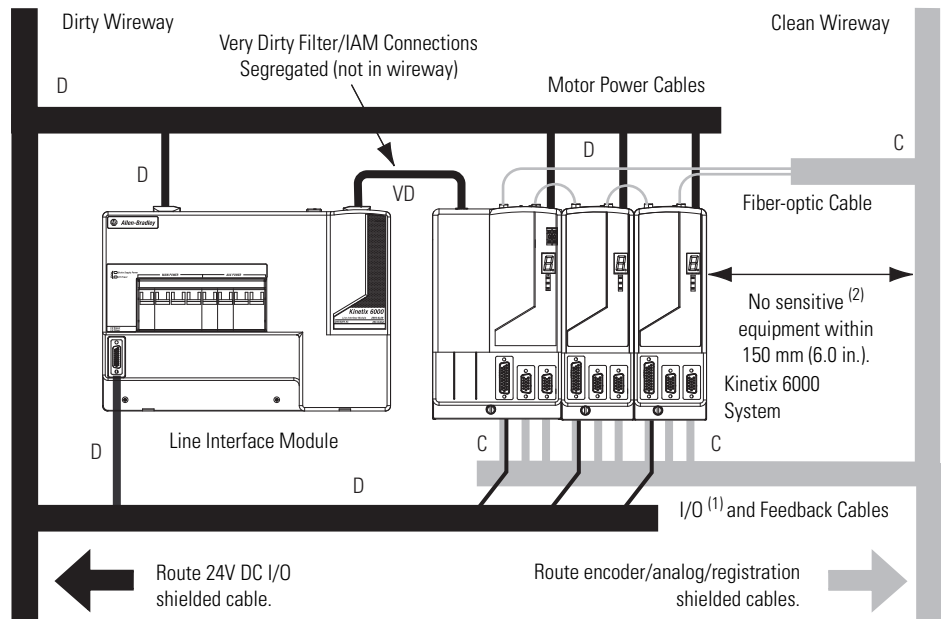
(2) When space does not permit the 150 mm (6.0 in.) segregation, use a grounded steel shield instead. For examples, refer to the System Design for Control of Electrical Noise Reference Manual, publication [GMC-BM001](#).

Observe these guidelines when a 2094-AL09 or 2094-BL02 LIM module is used in the Bulletin 2094 system and mounted left of the IAM module:

- The clean zone (C) is to the right and beneath the Bulletin 2094 system (gray wireway).
- The dirty zone (D) is to the left and above the Bulletin 2094 system, and above and below the LIM module (black wireway).
- The very dirty zone (VD) is limited to where the LIM module VAC output jumpers over to the IAM module. Shielded cable is required only if the very dirty cables enter a wireway.
- The SERCOS fiber-optic cables are immune to electrical noise, but due to their delicate nature, route them in the clean zone.

This layout is preferred due to the reduced size of the very dirty zone.

Figure 13 - Noise Zones (LIM mounted left of IAM module)



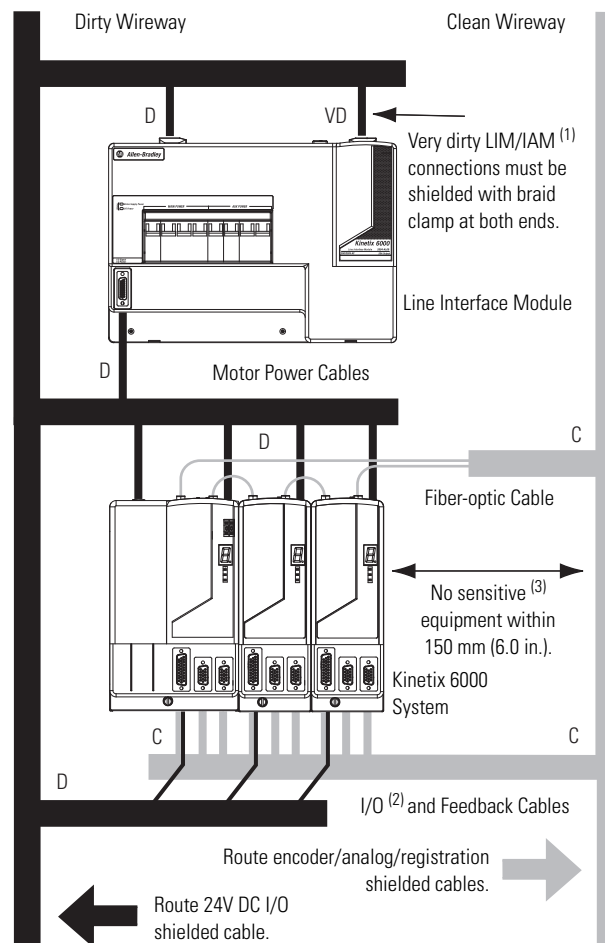
(1) If drive system I/O cable contains (dirty) relay wires, route cable with LIM module I/O cable in dirty wireway.

(2) When space does not permit the 150 mm (6.0 in.) segregation, use a grounded steel shield instead. For examples, refer to the System Design for Control of Electrical Noise Reference Manual, publication [GMC-RM001](#).

Observe these guidelines when the 2094-AL09 or 2094-BL02 LIM module is used in the Bulletin 2094 system and mounted above the IAM module:

- The clean zone (C) is to the right and beneath the Bulletin 2094 system (gray wireway).
- The dirty zone (D) is to the left and above the Bulletin 2094 system, and above and below the LIM module (black wireway).
- The LIM VAC output is very dirty (VD). Use shielded cable with a braid clamp attached at both ends of the cable to reduce the rating to dirty (D).
- The SERCOS fiber-optic cables are immune to electrical noise, but due to their delicate nature, route them in the clean zone.

Figure 14 - Noise Zones (LIM mounted above IAM module)

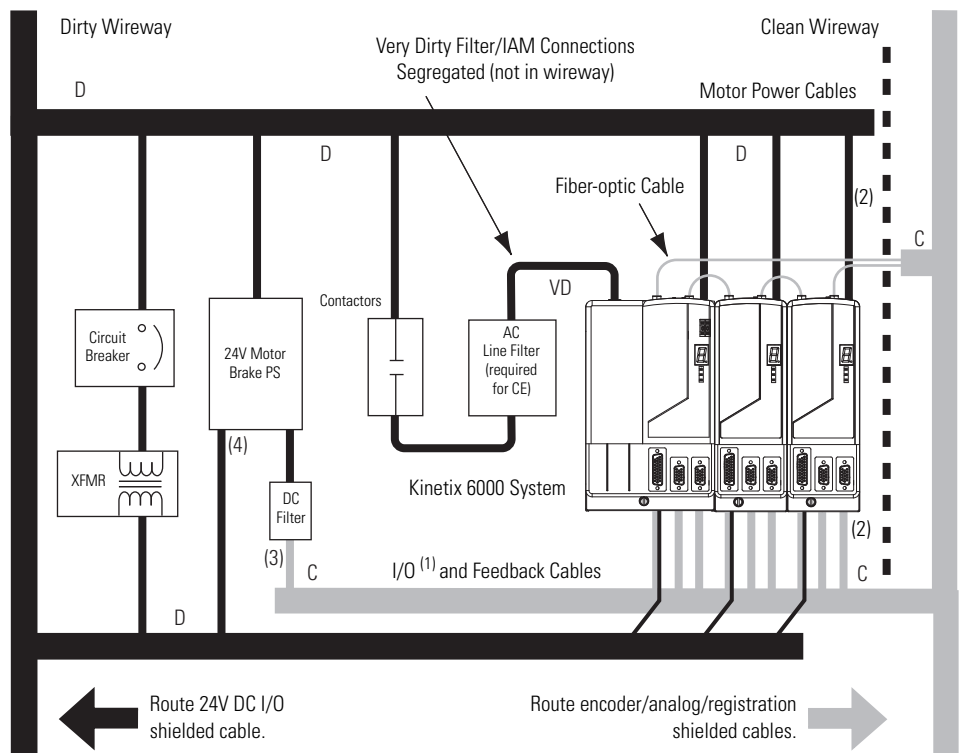


- (1) For examples of shield clamp attachment, refer to the System Design for Control of Electrical Noise Reference Manual, publication [GMC-RM001](#).
- (2) If drive system I/O cable contains (dirty) relay wires, route cable in dirty wireway.
- (3) When space does not permit the 150 mm (6.0 in.) segregation, use a grounded steel shield instead. For examples, refer to the System Design for Control of Electrical Noise Reference Manual, publication [GMC-RM001](#).

Observe these guidelines when individual input power components are used in the Bulletin 2094 system and the Bulletin 2094 LIM module is not used:

- The clean zone (C) is beneath the Bulletin 2094 system and includes the I/O wiring, feedback cable, and DC filter (gray wireway).
- The dirty zone (D) is above the Bulletin 2094 system (black wireway) and includes the circuit breakers, transformer, 24V DC power supply, contactors, AC line filter, and motor power cables.
- The very dirty zone (VD) is limited to where the AC line (EMC) filter VAC output jumpers over to the IAM module. Shielded cable is required only if the very dirty cables enter a wireway.
- The SERCOS fiber-optic cables are immune to electrical noise, but due to their delicate nature, route them in the clean zone.

Figure 15 - Noise Zones (without LIM module)

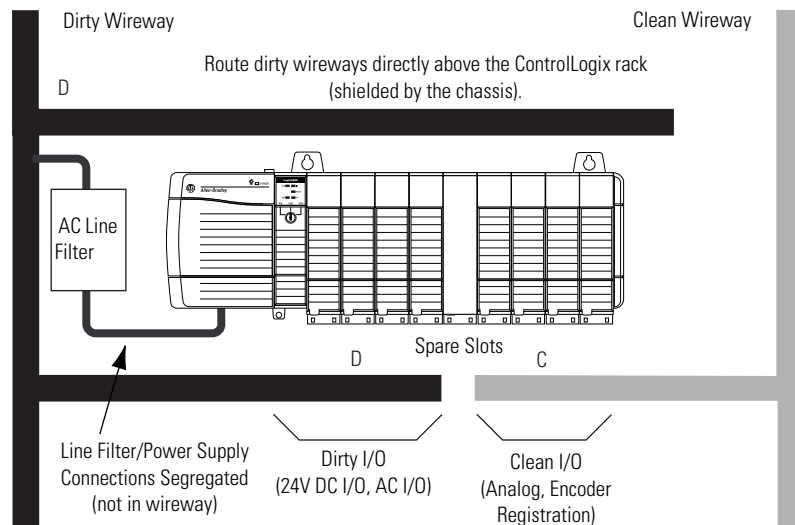


- (1) If drive system I/O cable contains (dirty) relay wires, route cable in dirty wireway.
- (2) When space to the right of the IAM does not permit 150 mm (6.0 in.) segregation, use a grounded steel shield instead. For examples, refer to the System Design for Control of Electrical Noise Reference Manual, publication [GMC-RM001](#).
- (3) This is a clean 24V DC available for any device that may require it. The 24V enters the clean wireway and exits to the right.
- (4) This is a dirty 24V DC available for motor brakes and contactors. The 24V enters the dirty wireway and exits to the left.

Observe these guidelines when installing your Logix platform SERCOS interface module:

- The clean zone (C) is beneath the less noisy modules (I/O, analog, encoder, registration, an so forth. (gray wireway).
- The dirty zone (D) is above and below the power supply and noisy modules (black wireway).
- The SERCOS fiber-optic cables are immune to electrical noise, but due to their delicate nature, route them in the clean zone.

Figure 16 - Noise Zones (ControlLogix chassis)



Cable Categories for Kinetix 6000 Systems

These tables indicate the zoning requirements of cables connecting to the Kinetix 6000 drive components.

Table 9 - IAM Module (converter side)

Wire/Cable	Connector	Zone			Method	
		Very Dirty	Dirty	Clean	Ferrite Sleeve	Shielded Cable
CTRL 1 and 2	CPD		X			
DC-/DC+ (unshielded cable)	IPD	X				
L1, L2, L3 (shielded cable)			X			X
L1, L2, L3 (unshielded cable)		X				
CONT EN- and CONT EN+ (M1 contactor)	CED		X			
DPI	DPI			X		X

Table 10 - AM Module or Axis Module (inverter side)

Wire/Cable	Connector	Zone			Method	
		Very Dirty	Dirty	Clean	Ferrite Sleeve	Shielded Cable
U, V, W (motor power)	MP		X			X
MBRK-, MBRK+ (motor brake)	BC		X			
MBRK-, MBRK+ (motor brake) 1326AB motors with resolver feedback			X		X	
DBRK-, DBRK+ (resistive brake)			X			
COM, PWR (24V DC), filtered ⁽¹⁾				X		
COM, PWR (24V DC), unfiltered ⁽²⁾			X			
COM, PWR (24V DC), safety enable, and feedback signals for safe-off feature	SO		X			
Motor feedback	MF			X		X
Auxiliary feedback	AF			X		X
Registration and analog outputs	IOD			X		X
Others			X			
Fiber-optic	Rx and Tx	No Restrictions				

(1) This is a clean 24V DC available for any device that may require it.

(2) This is a dirty 24V DC available for motor brakes and contactors.

Table 11 - Line Interface Module

Wire/Cable	Connector	Zone			Method	
		Very Dirty	Dirty	Clean	Ferrite Sleeve	Shielded Cable
VAC line (main input)	IPL		X			
Aux power input	APL		X			
VAC load (shielded option)	OPL		X			X
VAC load (unshielded option)		X				
Control power output	CPL		X			
MBRK PWR, MBRK COM	P1L/PSL		X			
Status I/O	IOI		X			
Aux power output	P2L		X			

Table 12 - External Shunt Module

Wire/Cable	Connector	Zone			Method	
		Very Dirty	Dirty	Clean	Ferrite Sleeve	Shielded Cable
COL, DC+ (shielded option)	RC		X			X
COL, DC+ (unshielded option)		X				
Thermal switch	TS		X			X
Fan (if present)	N/A		X			

Table 13 - Resistive Brake Module

Wire/Cable	Connections	Zone			Method	
		Very Dirty	Dirty	Clean	Ferrite Sleeve	Shielded Cable
Resistive brake module coil power	TB3-6 and TB3-7		X			
Resistive brake module I/O	TB1-1...TB1-5 and TB3-8		X			
Resistive brake module drive and motor power	TB1 and TB2		X			X
230V power	TB4		X			

Noise Reduction Guidelines for Drive Accessories

Refer to this section when mounting an AC (EMC) line filter or external shunt module for guidelines designed to reduce system failures caused by excessive electrical noise.

AC Line Filters

Observe these guidelines when mounting your AC (EMC) line filter (refer to the figure on [page 40](#) for an example):

- Mount the AC line filter on the same panel as the Kinetix 6000 drive and as close to the power rail as possible.
- Good HF bonding to the panel is critical. For painted panels, refer to the examples on [page 32](#).
- Segregate input and output wiring as far as possible.

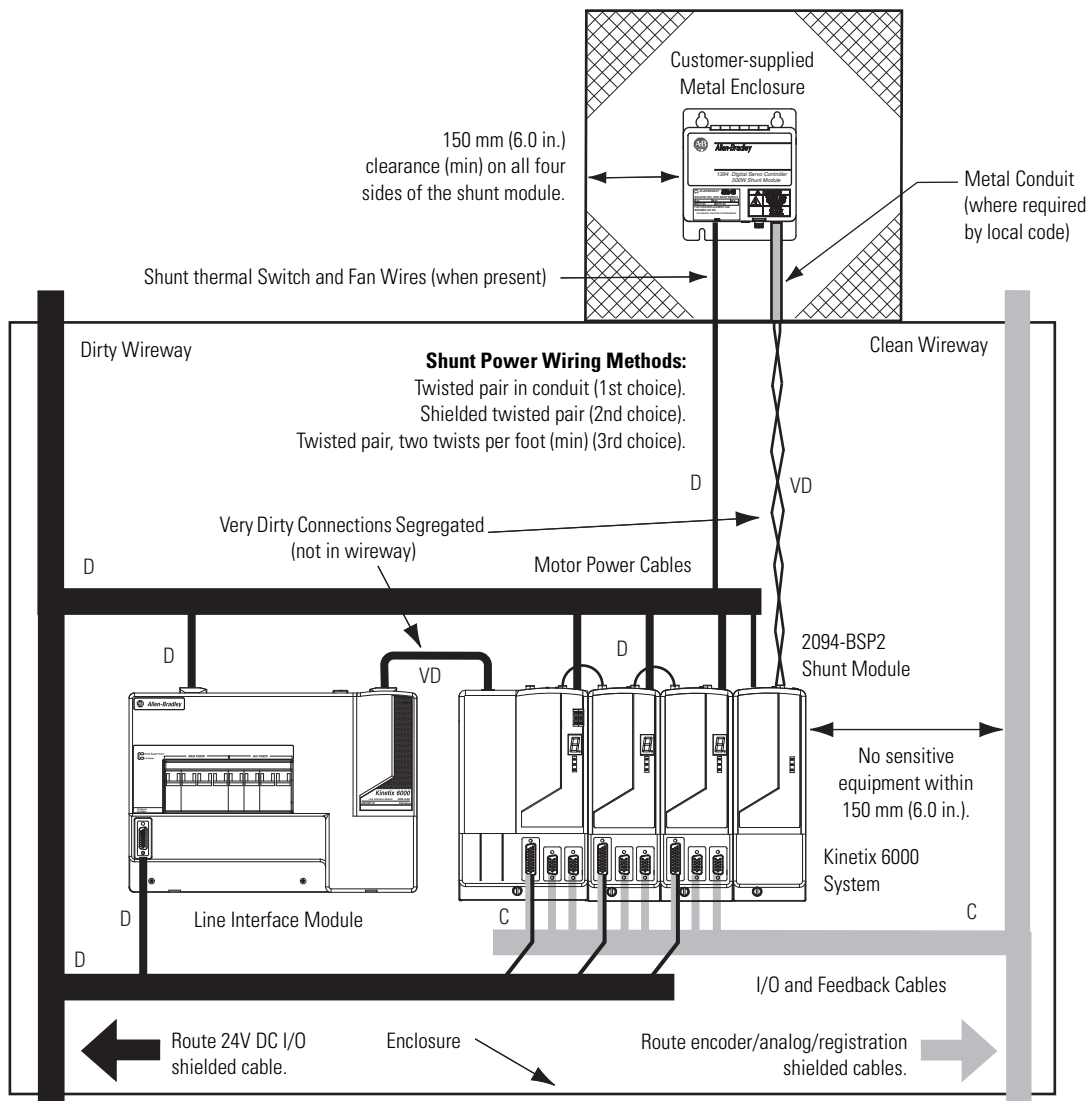
IMPORTANT CE test certification applies only to AC line filter and single power rail. Sharing a line filter with multiple power rails may perform satisfactorily, but the user takes legal responsibility.

External Shunt Modules

Observe these guidelines when mounting your external shunt module outside the enclosure:

- Mount circuit components and wiring in the very dirty zone or in an external shielded enclosure. Run shunt power and fan wiring inside metal conduit to minimize the effects of EMI and RFI.
- Mount resistors (other than metal-clad) in a shielded and ventilated enclosure outside the cabinet.
- Keep unshielded wiring as short as possible. Keep shunt wiring as flat to the cabinet as possible.
- Route thermal switch and fan wires separate from shunt power.

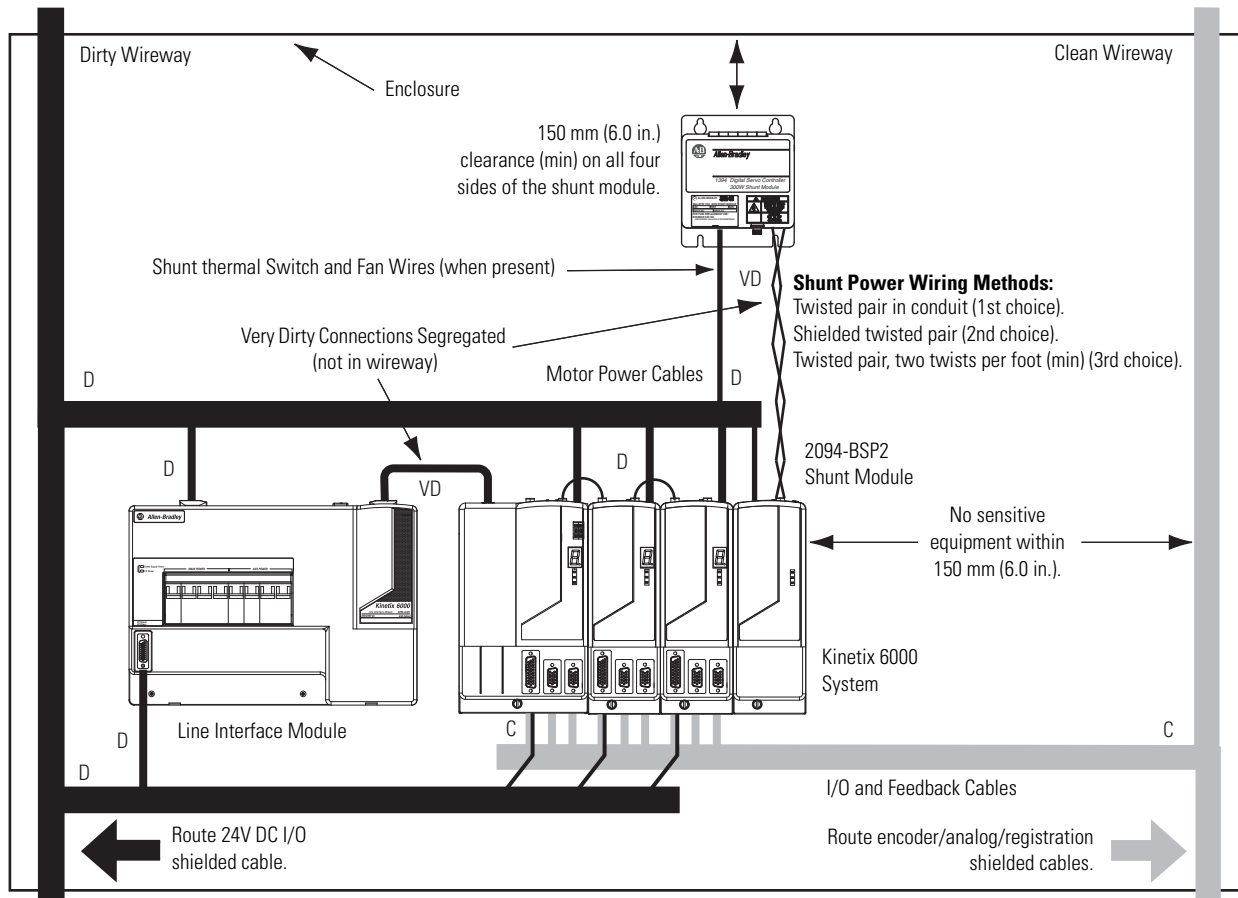
Figure 17 - External Shunt Module Outside the Enclosure



When mounting your shunt module inside the enclosure, follow these additional guidelines:

- Mount metal-clad modules anywhere in the dirty zone, but as close to the Bulletin 2094 drive system as possible.
- Route shunt power wires with motor power cables.
- Keep unshielded wiring as short as possible. Keep shunt wiring as flat to the cabinet as possible.
- Separate shunt power cables from other sensitive, low voltage signal cables.

Figure 18 - External Shunt Module Inside the Enclosure

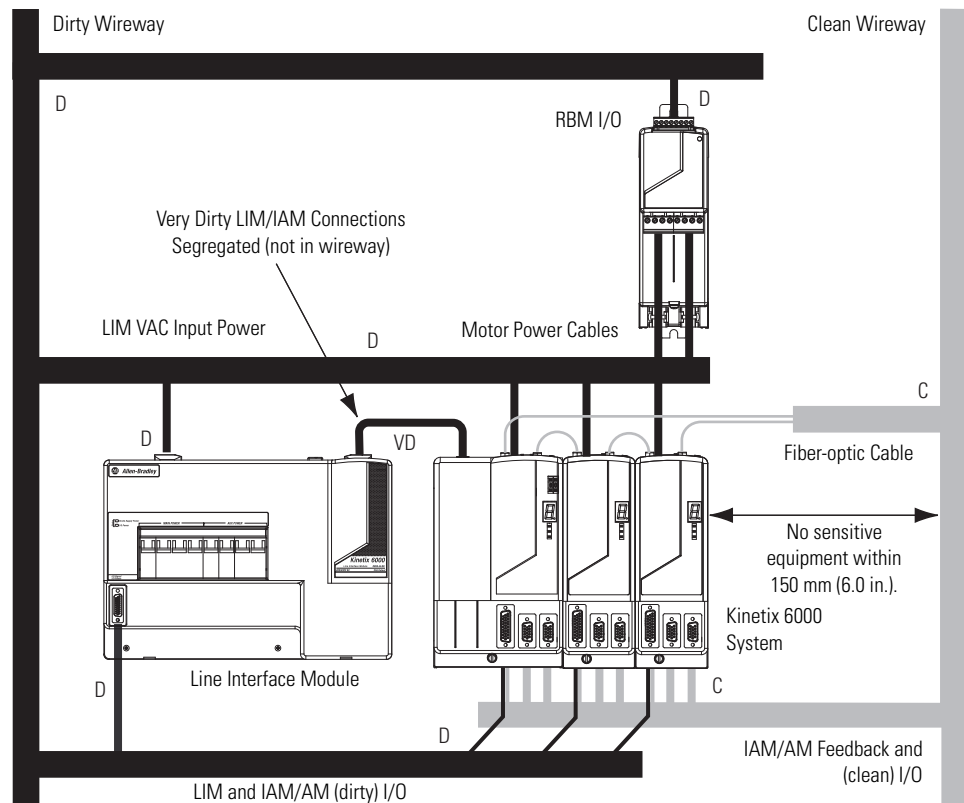


Resistive Brake Modules

Observe these guidelines when mounting your RBM module:

- Mount circuit components and wiring in the dirty zone or in an external shielded enclosure. If mounting the RBM module in a separate ventilated shielded enclosure, run wiring inside metal conduit to minimize the effects of EMI and RFI.
- Keep unshielded wiring as short as possible. Keep wiring as flat to the cabinet as possible.
- Route RBM module power and I/O cables separate from other sensitive low voltage signal cables.

Figure 19 - Noise Zones (RBM mounted above AM module)



Motor Brake and Thermal Switch

The thermal switch and brake are mounted inside the motor, but how you connect to the axis module depends on the motor series.

Refer to Wire the Motor/Resistive Brake (BC) Connector on [page 106](#) for wiring guidelines. Refer to Axis Module/Rotary Motor Wiring Examples beginning on [page 212](#) for the interconnect diagram of your drive/motor combination.

Mounting the Kinetix 6000 Drive System

Introduction

This chapter provides the system installation procedures for mounting your Kinetix 6000 drive components on the Bulletin 2094 power rail.

Topic	Page
Introduction	47
Determine Mounting Order	48
Mount Modules on the Power Rail	49

This procedure assumes you have prepared your panel, mounted your Bulletin 2094 power rail, and understand how to bond your system. For installation instructions regarding equipment and accessories not included here, refer to the instructions that came with those products.



SHOCK HAZARD: To avoid hazard of electrical shock, perform all mounting and wiring of the Bulletin 2094 power rail and drive modules prior to applying power. Once power is applied, connector terminals may have voltage present even when not in use.



ATTENTION: Plan the installation of your system so that you can perform all cutting, drilling, tapping, and welding with the system removed from the enclosure. Because the system is of the open type construction, be careful to keep any metal debris from falling into it. Metal debris or other foreign matter can become lodged in the circuitry, which can result in damage to components.

Using the 2094 Mounting Brackets

You can use Bulletin 2094 mounting brackets to mount the power rail or LIM module over the AC line filter. Refer to the 2094 Mounting Brackets Installation Instructions, publication [2094-IN008](#), when using mounting brackets with your Kinetix 6000 drive system.

Installing the 2094 Power Rail

The Bulletin 2094 power rail comes in lengths to support one IAM module and up to seven additional AM modules, or up to six additional AM modules and one shunt module. The connector pins for each slot are covered by a protective boot. The boot is designed to protect the pins from damage and make sure that no foreign objects lodge between the pins during installation. Refer to the Kinetix 6000 Power Rail Installation Instructions, publication [2094-IN003](#), when installing your power rail.

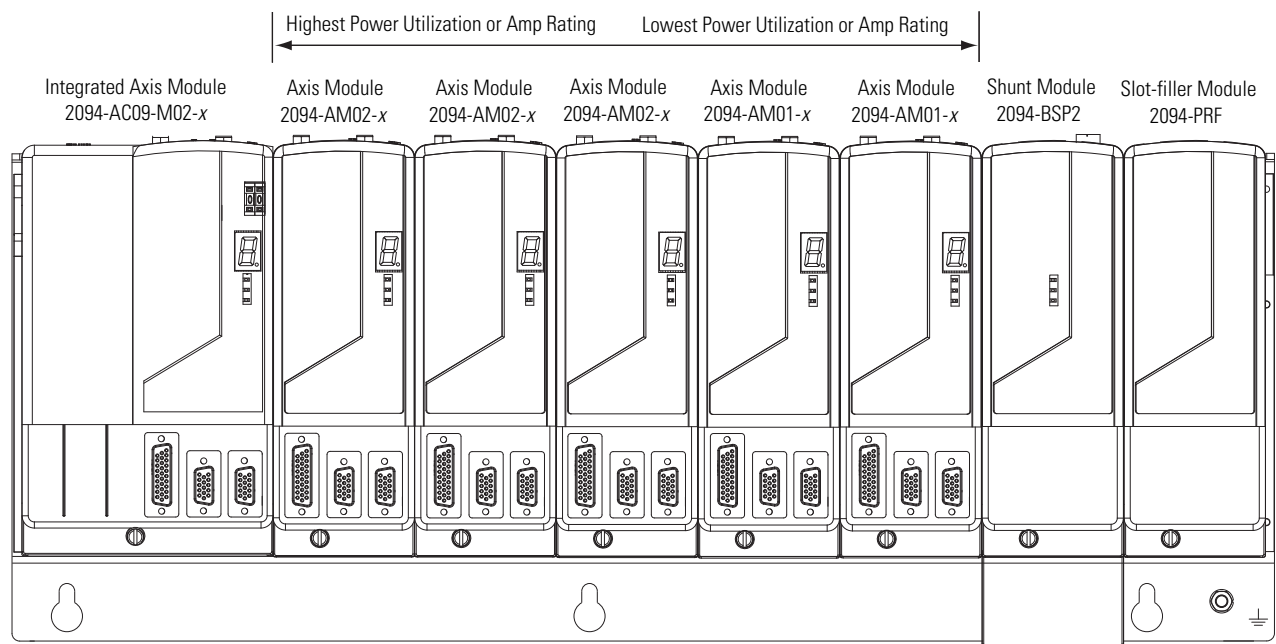


ATTENTION: To avoid damage to the power rail during installation, do not remove the protective boots until the module for each slot is ready for mounting.

Determine Mounting Order

Mount IAM, AM, shunt, and slot-filler modules in the order (left to right) as shown. Mount axis modules according to power utilization (highest to lowest) from left to right starting with the highest power utilization. If power utilization is unknown, position axis modules (highest to lowest) from left to right based on amp rating.

Figure 20 - Module Mounting Order Example



IMPORTANT

The IAM module must be positioned in the leftmost slot of the power rail. Position your AM modules, shunt module, and slot-filler modules to the right of the IAM module.

The shunt module must be installed to the right of the last AM module. Only slot-filler modules may be installed to the right of the shunt module.

Do not mount the shunt module on power rails with a follower IAM module. Common-bus follower IAM modules will disable the internal, rail mounted, and external shunt modules.



SHOCK HAZARD: To avoid personal injury due to electrical shock, place a 2094-PRF slot-filler module in all empty slots on the power rail. Any power rail connector without a module installed will disable the Bulletin 2094 system; however, control power will still be present.

Mount Modules on the Power Rail

Follow these steps to mount the IAM, AM, shunt, and slot-filler modules.

TIP

All modules mount to the power rail by using the same technique; however, only the IAM module is shown.

1. Remove the protective boots from the power rail connectors.

IMPORTANT

The IAM module must be positioned in the leftmost slot of the power rail. Position your axis modules, shunt module, and slot-filler modules to the right of the IAM module.

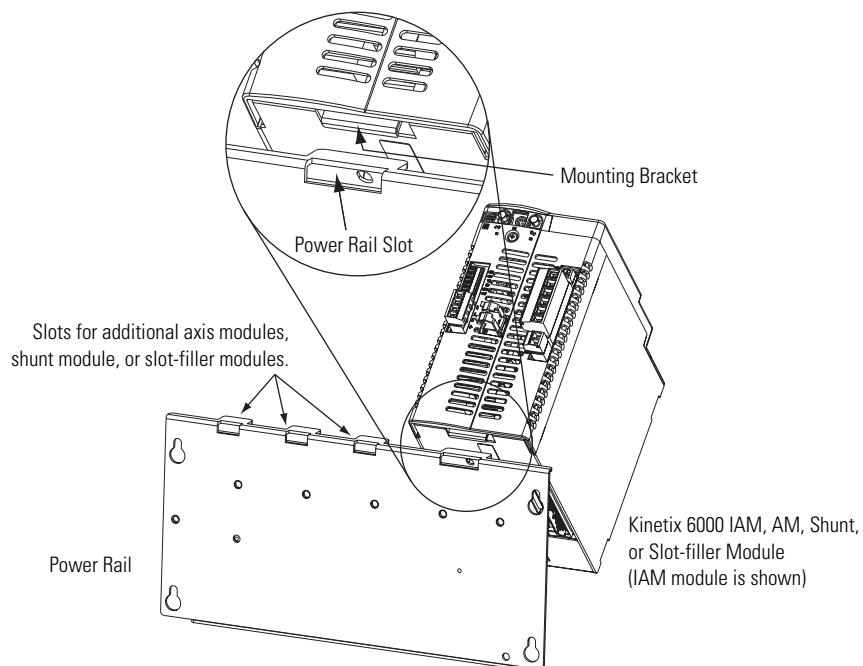
2. Determine the next available slot and module for mounting.
3. Remove the label (applied to back and side of module) covering the pins that mate with the power rail.



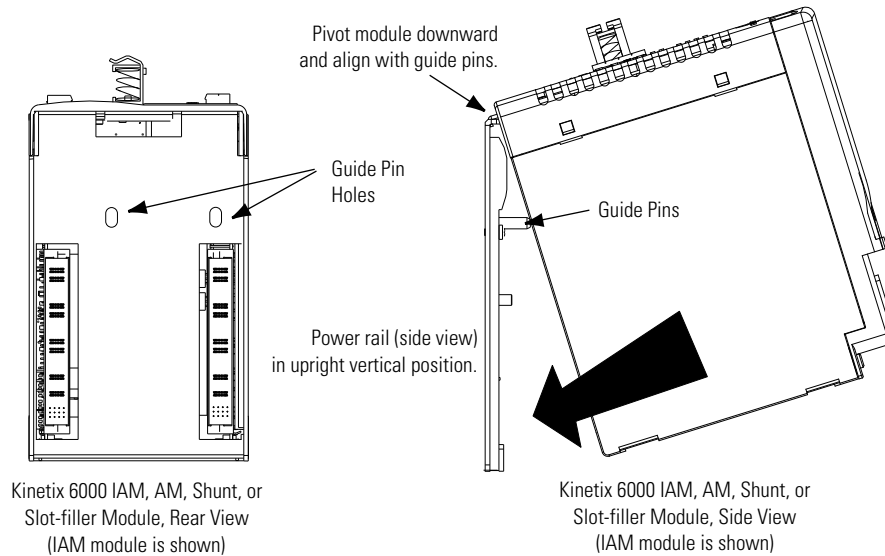
ATTENTION: To avoid damage to the pins located on the back of each IAM, AM, shunt, and slot-filler module and to make sure that module pins mate properly with the power rail, hang modules as shown in [steps 4...7](#).

The power rail must be mounted vertically on the panel before hanging modules on the power rail. Do not mount modules if the power rail is horizontal.

4. Hang the mounting bracket from the slot on the power rail.



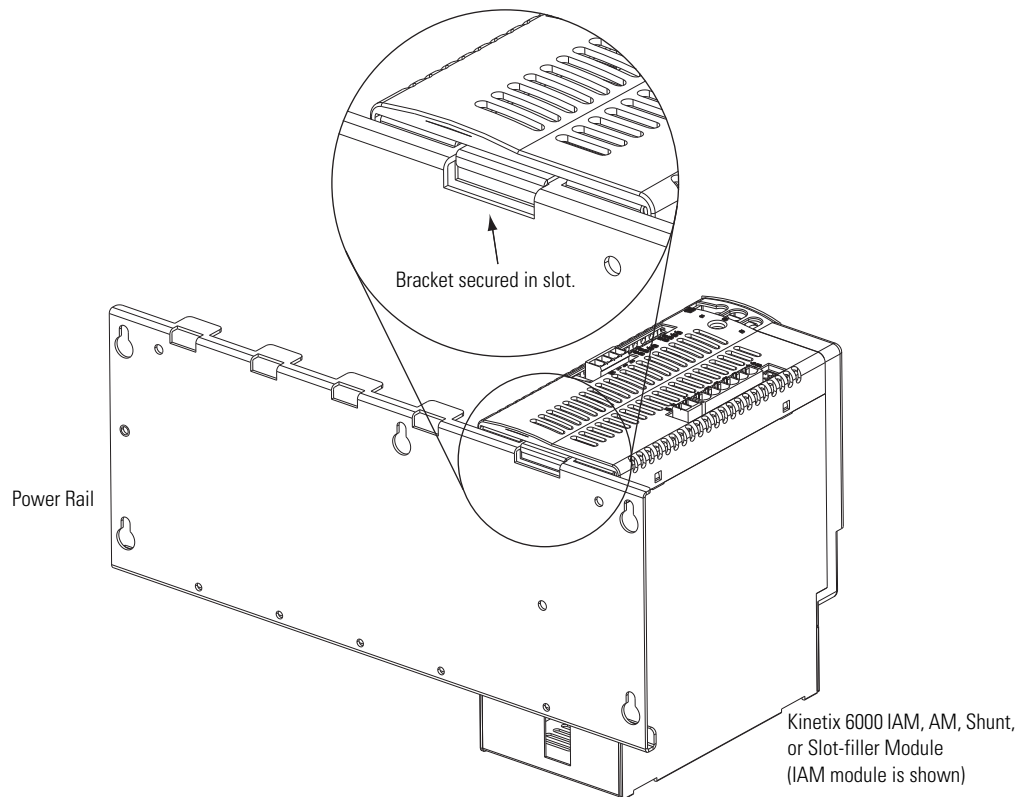
5. Pivot module downward and align the guide pins on the power rail with the guide pin holes in the back of the module.



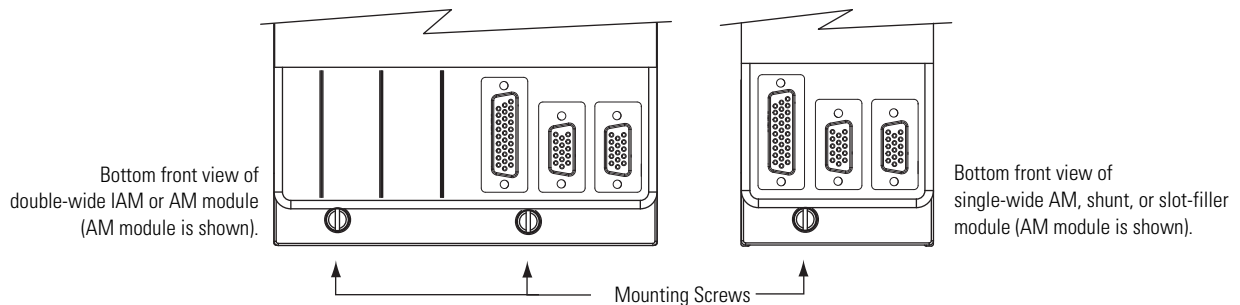
TIP

The IAM module can have two or three power rail connectors and guide pins, the AM module can have one or two, all other modules have one.

6. Gently push the module against the power rail connectors and into the final mounting position.



7. Use 2.26 N•m (20 lb•in) torque to tighten the mounting screws.



IMPORTANT

There are two mounting screws when mounting 2094-AC32-M05-x, 2094-BC04-M03-x, and 2094-BC07-M05-x (double-wide) IAM modules, and 2094-BM03-x and 2094-BM05-x (double-wide) AM modules.

8. Repeat [steps 1...7](#) for each AM, shunt, or slot-filler module in your Bulletin 2094 drive system.

Notes:

Kinetix 6000 Connector Data

Introduction

This chapter provides power, feedback, and I/O connector locations and signal descriptions for your Kinetix 6000 drive.

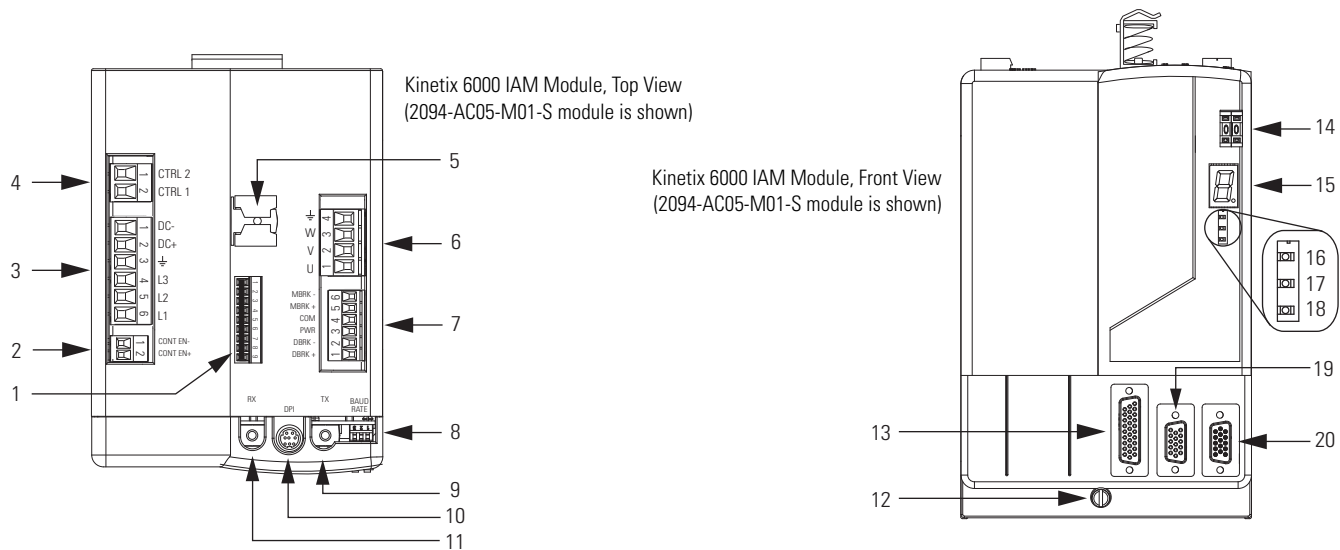
Topic	Page
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Power Module and Control Module Features	58
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Power and Relay Specifications	67
Feedback Specifications	73

IAM/AM Module Features

Use these illustrations to identify the features and indicators for the IAM/AM modules.

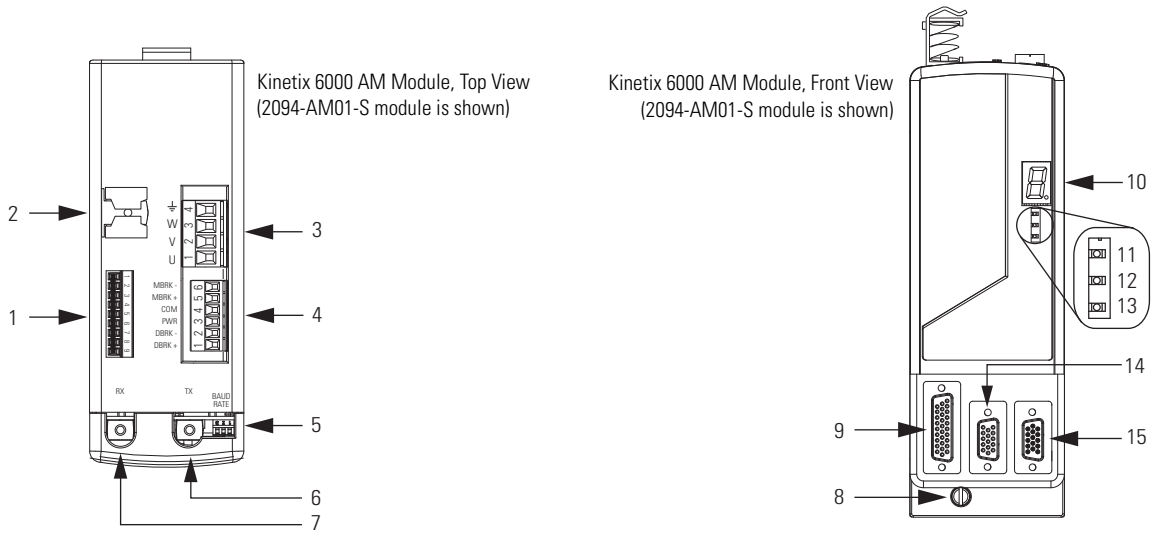
Although the physical size of the 460V modules is larger than the 230V modules, the location of the features and indicators is identical.

Figure 21 - Integrated Axis Module Features and Indicators



Item	Description
1	Safe-off (SO) connector
2	Contactor enable (CED) connector
3	DC bus/AC input power (IPD) connector
4	Control power (CPD) connector
5	Motor cable shield clamp
6	Motor power (MP) connector
7	Motor/resistive brake (BC) connector
8	SERCOS communication rate and optical power switches
9	SERCOS transmit (Tx) connector
10	DPI connector

Item	Description
11	SERCOS receive (Rx) connector
12	Mounting screw
13	I/O (IOD) connector
14	SERCOS node address switch
15	Seven-segment fault status indicator
16	Drive status indicator
17	COMM status indicator
18	Bus status indicator
19	Motor feedback (MF) connector
20	Auxiliary feedback (AF) connector

Figure 22 - Axis Module Features and Indicators

Item	Description
1	Safe-off (SO) connector
2	Motor cable shield clamp
3	Motor power (MP) connector
4	Motor/resistive brake (BC) connector
5	SERCOS communication rate and optical power switches

Item	Description
6	SERCOS transmit (Tx) connector
7	SERCOS receive (Rx) connector
8	Mounting screw
9	I/O (IOD) connector
10	Seven-segment fault status indicator

Item	Description
11	Drive status indicator
12	COMM status indicator
13	Bus status indicator
14	Motor feedback (MF) connector
15	Auxiliary feedback (AF) connector

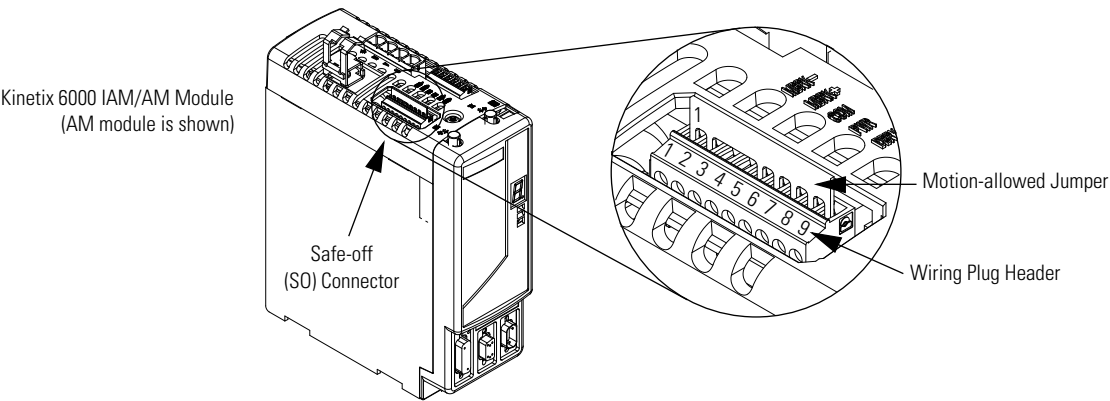
Table 14 - Kinetix 6000 IAM/AM Module Connectors

Designator	Description	Connector	Module
IOD	User I/O (drive)	26-pin high-density D-shell (female)	IAM/AM
MF	Motor feedback	15-pin high-density D-shell (female)	IAM/AM
AF	Auxiliary feedback	15-pin high-density D-shell (male)	IAM/AM
CPD	Control input power (drive)	2-position plug/header	IAM
IPD	VAC input power (drive) and DC bus	6-position plug/header	IAM
CED	Contactor enable	2-position plug/header	IAM
MP	Motor power	4-position plug/header	IAM/AM
BC	Motor/Resistive brake	6-position plug/header	IAM/AM
SO	Safe-off	9-position plug/header	IAM/AM
Tx and Rx	SERCOS transmit and receive	SERCOS fiber-optic (2)	IAM/AM
DPI	DPI	DPI	IAM

Safe-off Connector Pinout

Each 2094-*xCxx-Mxx-S* IAM module and 2094-*xMxx-S* AM module ships with the (9-pin) wiring-plug header and motion-allowed jumper installed in the safe-off (SO) connector. With the motion-allowed jumper installed, the safe-off feature is not used.

Figure 23 - Motion-allowed Jumper



Headers in this table extend the safe-off (SO) connector signals for use in wiring single and multiple safe-off drive configurations, or to defeat (not use) the safe-off feature.

Table 15 - IAM/AM Safe-off 9-pin (SO) Connector

Safe-off (SO) Connector Pin	Also Applies to These SO Connector Headers	Description	Signal
1	- Wiring plug header - First-drive wiring header (2090-XNSM-W)	One side of the normally-closed monitoring contact of relay 2	FDBK2+
2		Other side of the normally-closed monitoring contact of relay 2	FDBK2-
3		One side of the normally-closed monitoring contact of relay 1	FDBK1+
4		Other side of the normally-closed monitoring contact of relay 1	FDBK1-
5		Coil of safety-relay 2	SAFETY ENABLE2+
6		Return for safety-relay coil power (both relays)	SAFETY ENABLE-
7		Coil of safety relay 1	SAFETY ENABLE1+
8	- Wiring plug header - Motion-allowed jumper	Power for continuous enable of the safety function, 500 mA max	24V+
9		Power return used for continuous enable of safety function	24V_COM

IMPORTANT Pins SO-8 and SO-9 (24V+) are used by only the motion-allowed jumper. When wiring to the wiring-plug header, the 24V supply must come from an external source.

Refer to the Kinetix Safe-off Feature Safety Reference Manual, publication [GMC-RM002](#), for more information on wiring safe-off headers.

I/O Connector Pinout

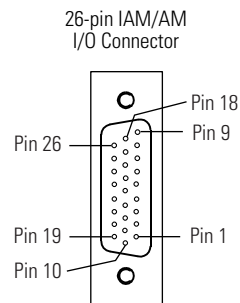
Table 16 - IAM/AM I/O 26-pin (IOD) Connector

IOD Pin	Description	Signal
1	Hardware enable 24V DC power supply	+24V_PWR
2	Hardware enable input	ENABLE
3	Common	+24V_COM
4	Home switch 24V DC power supply	+24V_PWR
5	Home switch input	HOME
6	Common	+24V_COM
7	Positive overtravel 24V DC power supply	+24V_PWR
8	Positive overtravel limit switch input	OT+
9	Common	+24V_COM
10	Negative overtravel 24V DC power supply	+24V_PWR
11	Negative overtravel limit switch input	OT-
12	Common	+24V_COM
13	24V registration power	REG_24V

IOD Pin	Description	Signal
14	High speed registration 1 input	REG1
15	Common for registration	REG_COM
16	24V registration power	REG_24V
17	High speed registration 2 input	REG2
18	Common for registration	REG_COM
19	Reserved	—
20	Reserved	—
21	Reserved	—
22	Reserved	—
23	Analog output 0	DAC0
24	Analog output common	DAC_COM
25	Analog output 1	DAC1
26	Analog output common	DAC_COM

IMPORTANT Signals +24V_PWR and +24V_COM are a 24V DC source you can use only for the inputs listed above.

Figure 24 - Pin Orientation for 26-pin I/O (IOD) Connector



Motor Feedback Connector Pinout

Table 17 - Stegmann Hiperface (SRS/SRM)

MF Pin	Description	Signal
1	Sine differential input+	SIN+
2	Sine differential input-	SIN-
3	Cosine differential input+	COS+
4	Cosine differential input-	COS-
5	Hiperface data channel	DATA+
6	Common	ECOM
7	Encoder power (+9V)	EPWR_9V ⁽²⁾
8	Reserved	—

(1) Not applicable unless motor has integrated thermal protection.

(2) Encoder power supply uses either 5V or 9V DC based on encoder/motor used.

MF Pin	Description	Signal
9	Reserved	—
10	Hiperface data channel	DATA-
11	Motor thermal switch (normally closed) ⁽¹⁾	TS
12	Reserved	—
13	Reserved	—
14	Encoder power (+5V)	EPWR_5V ⁽²⁾
15	Reserved	—

Table 18 - TTL or Sine/Cosine with Index Pulse and Hall Commutation

MF Pin	Description	Signal
1	AM+ / Sine differential input+	AM+ / SIN+
2	AM- / Sine differential input-	AM- / SIN-
3	BM+ / Cosine differential input+	BM+ / COS+
4	BM- / Cosine differential input-	BM- / COS-
5	Index pulse+	IM+
6	Common	ECOM
7	Encoder power (+9V)	EPWR_9V ⁽²⁾
8	Single-ended 5V hall effect commutation	S3

(1) Not applicable unless motor has integrated thermal protection.

(2) Encoder power supply uses either 5V or 9V DC based on encoder/motor used.

MF Pin	Description	Signal
9	Reserved	—
10	Index pulse-	IM-
11	Motor thermal switch (normally closed) ⁽¹⁾	TS
12	Single-ended 5V hall effect commutation	S1
13	Single-ended 5V hall effect commutation	S2
14	Encoder power (+5V)	EPWR_5V ⁽²⁾
15	Reserved	—

Table 19 - Resolver Transmitter (transformation ratio = 0.25)

MF Pin	Description	Signal
1	Sine differential input+	S2
2	Sine differential input-	S4
3	Cosine differential input+	S1
4	Cosine differential input-	S3
5	Resolver excitation	R1
6	Common	ECOM
7	Reserved	—
8	Reserved	—

(1) Not applicable unless motor has integrated thermal protection.

(2) If using 1326AB (resolver-based) motors, use 2090-K6CK-D15MF Low-profile Connector Kits that connect the filtered thermal switch (pins 16 and 17) to MF-11 and MF-6.

MF Pin	Description	Signal
9	Reserved	—
10	Resolver excitation	R2
11	Motor thermal switch (normally closed) ⁽¹⁾⁽²⁾	TS
12	Reserved	—
13	Reserved	—
14	Reserved	—
15	Reserved	—

Kinetix 6000 drives do not support Heidenhain EnDat high-resolution feedback; however, you can use the 2090-K6CK-KENDAT feedback module to convert Heidenhain EnDat high-resolution feedback to Stegmann Hiperface. Pin numbers in the table below refer to pins in the feedback module.

IMPORTANT Only 2094-xCxx-Mxx-S and 2094-xMxx-S drives with firmware revision 1.116 support the use of 2090-K6CK-KENDAT feedback modules for EnDat to Hiperface conversion.

Table 20 - Heidenhain EnDat

Pin	Description	Signal	Pin	Description	Signal
1	Sine differential input+	SIN+	8	Serial data clock signal -	CLK-
2	Sine differential input-	SIN-	9	Serial data differential signal+	DATA+
3	Cosine differential input+	COS+	10	Serial data differential signal -	DATA-
4	Cosine differential input-	COS-	11	Motor thermal switch+ ⁽¹⁾	TS+
5	Encoder power (+5V)	EPWR_5V	12	Motor thermal switch- ⁽²⁾	TS-
6	Common	ECOM	13	Reserved	—
7	Serial data clock signal +	CLK+			

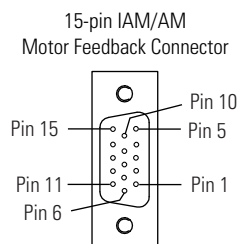
(1) Not applicable unless motor has integrated thermal protection.

(2) When used with Allen-Bradley motors and Bulletin 2090 cables, pin 12 is reserved.

IMPORTANT Combined motor-power cable length for all axes on the same DC bus must not exceed 240 m (787 ft) with 460V systems or 160 m (525 ft) with 230V systems. Drive-to-motor power cables must not exceed 90 m (295.5 ft).

System performance was tested at these cable length specifications. These limitations also apply when meeting CE requirements.

Figure 25 - Pin Orientation for 15-pin Motor Feedback (MF) Connector



Auxiliary Feedback Connector Pinout

For TTL devices, the position count will increase when A leads B. For sinusoidal devices, the position count will increase when cosine leads sine.

Table 21 - Stegmann Hiperface (SRS and SRM only)

AF Pin	Description	Signal
1	Sine differential input+	SIN+
2	Sine differential input-	SIN-
3	Cosine differential input+	COS+
4	Cosine differential input-	COS-
5	Hiperface data channel	DATA+
6	Common	ECOM
7	Encoder power (+9V)	EPWR_9V ⁽¹⁾
8	Reserved	—

(1) Encoder power supply uses either 5V or 9V DC based on encoder/motor used.

AF Pin	Description	Signal
9	Reserved	—
10	Hiperface data channel	DATA-
11	Reserved	—
12	Reserved	—
13	Reserved	—
14	Encoder power (+5V)	EPWR_5V ⁽¹⁾
15	Reserved	—

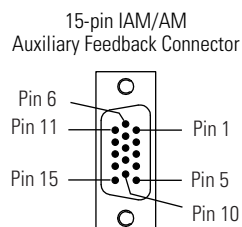
Table 22 - TTL or Sine/Cosine with Index Pulse

AF Pin	Description	Signal
1	A+ / Sine differential input+	A+ / SIN+
2	A- / Sine differential input-	A- / SIN-
3	B+ / Cosine differential input+	B+ / COS+
4	B- / Cosine differential input-	B- / COS-
5	Index pulse+	I+
6	Common	ECOM
7	Encoder power (+9V)	EPWR_9V ⁽¹⁾
8	Reserved	—

(1) Encoder power supply uses either 5V or 9V DC based on encoder/motor used.

AF Pin	Description	Signal
9	Reserved	—
10	Index pulse-	I-
11	Reserved	—
12	Reserved	—
13	Reserved	—
14	Encoder power (+5V)	EPWR_5V ⁽¹⁾
15	Reserved	—

Figure 26 - Pin Orientation for 15-pin Auxiliary Feedback (AF) Connector



IAM Input Connector Pinout

Table 23 - Control Power Connector

CPD Pin	Description	Signal
1	Control power VAC input	CTRL 2
2		CTRL 1

Table 24 - DC Bus and Input Power Connector

IPD Pin	Description	Signal
1	An integral, unregulated power supply, consisting of AC line input, three-phase bridge rectifier, and filter capacitors.	DC-
2		DC+
3	Chassis ground.	
4	Three-phase input power.	L3
5		L2
6		L1

Table 25 - Contactor Enable Connector

CED Pin	Description	Signal
1	Relay-driven dry contact used in the safety string for a three-phase power contactor.	CONT EN-
2		CONT EN+

IAM and AM Motor Power and Brake Connector Pinout

Table 26 - Motor Power Connector

MP Pin	Description	Signal
4	Chassis ground	$\perp$
3	Three-phase motor power	W
2		V
1		U

IMPORTANT Combined motor-power cable length for all axes on the same DC bus must not exceed 240 m (787 ft) with 460V systems or 160 m (525 ft) with 230V systems. Drive-to-motor power cables must not exceed 90 m (295.5 ft).

System performance was tested at these cable length specifications. These limitations also apply when meeting CE requirements.

Table 27 - Motor Brake/Resistive Brake Connector

BC Pin	Description	Signal
6	Motor brake connections	MBRK-
5		MBRK+
4	Motor brake common	COM
3	+24V brake input power (from LIM module or customer supplied)	PWR
2	RBM module connections (from RBM module and safety string)	DBRK-
1		DBRK+

Control Signal Specifications

This section provides a description of the Kinetix 6000 drive I/O (IOD), communication, contactor enable (CED), brake (BC), and control power (CPD) connectors.

Digital Inputs

Two fast registration inputs and four other inputs are available for the machine interface on the IAM module and AM module. Each IAM and AM module supplies 24V DC @ 250 mA for the purpose of registration, home, enable, over-travel positive, and over-travel negative inputs. These are sinking inputs that require a sourcing device. A 24V DC power and common connection is provided for each input.

IMPORTANT To improve registration input EMC performance, refer to the System Design for Control of Electrical Noise Reference Manual, publication [GMC-RM001](#).

IMPORTANT Over-travel limit input devices must be normally closed.

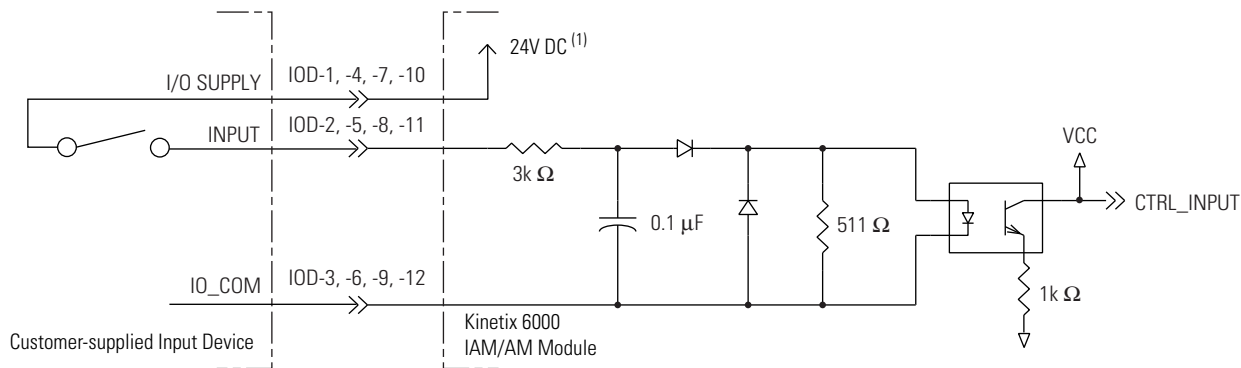
Table 28 - Understanding Digital Inputs

IOD Pin	Signal	Description	Capture Time	Edge/Level Sensitive
IOD-2	ENABLE	Optically isolated, single-ended active high signal. Current loading is nominally 10 mA. A 24V DC input is applied to this terminal to enable each axis.	20 ms	Level
IOD-5	HOME	Optically isolated, single-ended active high signal. Current loading is nominally 10 mA. Home switch (normally open contact) inputs for each axis require 24V DC (nominal).	20 ms	Level
IOD-14 IOD-17	REG1 REG2	Fast registration inputs are required to inform the motor interface to capture the positional information with less than 3 μ s uncertainty. Optically isolated, single-ended active high signal. Current loading is nominally 10 mA. A 24V DC input is applied to this terminal to enable each axis.	500 ns	Edge
IOD-8 IOD-11	OT+ OT-	Overtravel detection is available as an optically isolated, single-ended active high signal. Current loading is nominally 10 mA per input. The pos/neg limit switch (normally closed contact) inputs for each axis require 24V DC (nominal).	20 ms	Level

Table 29 - Digital Input Specifications

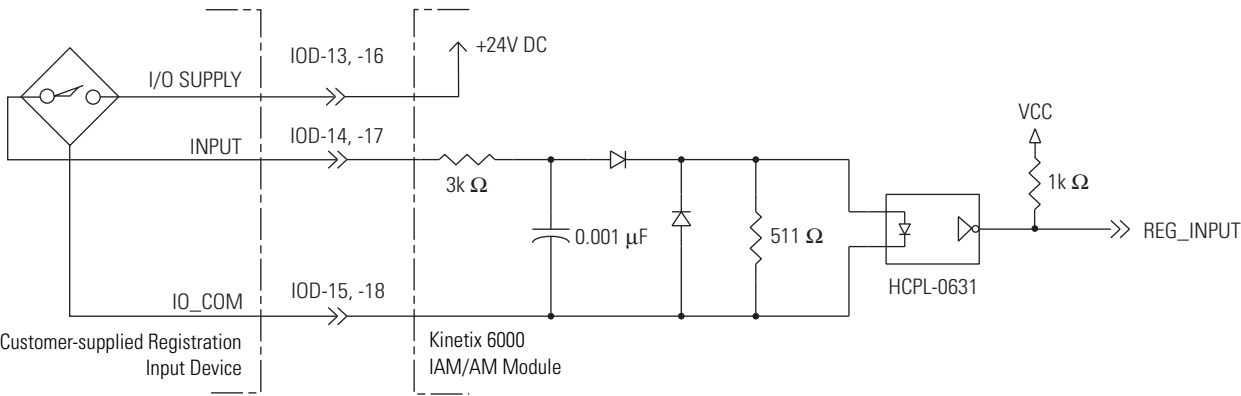
Parameter	Description		Min	Max
On-state voltage	Voltage applied to the input, with respect to IOCOM, to guarantee an on-state.	ENABLE, HOME, and OT+/OT-	10.8V	26.4V
		REG1 and REG2	21.6V	26.4V
On-state current	Current flow to guarantee an on-state.		3.0 mA	10.0 mA
Off-state voltage	Voltage applied to the input, with respect to IOCOM, to guarantee an off-state.		-1.0V	3.0V

Figure 27 - Enable, Home, and Overtravel Digital Input Circuits



(1) 24V DC source (range) = 21.6V - 26.4V (supplied by drive, not to exceed 250 mA total).
Maximum current input = 10 mA.

Figure 28 - Registration Digital Input Circuits



SERCOS Communication Specifications

The Rx and Tx SERCOS connectors are provided on the Kinetix 6000 IAM and AM module for communication with the Logix controller.

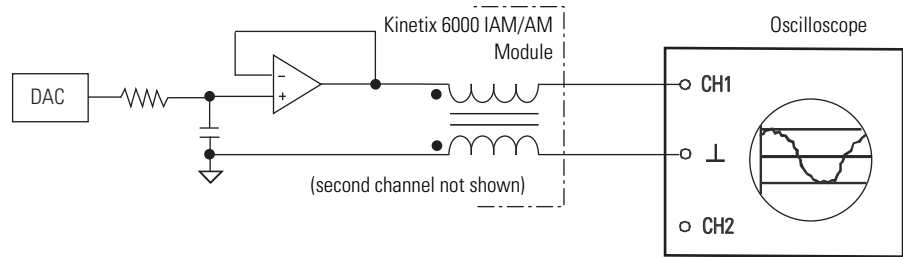
Attribute	Value
Data rates	4 and 8 Mbps, selectable via DIP switch
Light intensity	Low power or high power, selectable via DIP switch
Cyclic update period	500 μs, min
Node addresses	01...99 ⁽¹⁾

(1) Node address assignments begin with the IAM module. Node addresses for additional axes on the same power rail are assigned by incrementing from left to right (starting with the IAM module address).

Analog Outputs

The IAM and AM modules include two analog outputs (IOD-23 and IOD-25) that you can configure through software to represent drive variables.

Figure 29 - Analog Output Circuit



IMPORTANT Output values can vary during powerup until the specified power supply voltage is reached.

Table 30 - Analog Output Specifications

Parameter	Description		Min	Max
Resolution	Number of states that the output signal is divided into, which is 2 ^(to the number of bits) .		—	±11 bits
Output current	Current capability of the output.		0	+2 mA
Output signal range	Range of the output voltage.	2094-xCxx-Mxx and 2094-xMxx drives	0	+5V
		2094-xCxx-Mxx-S and 2094-xMxx-S drives	0	+10V
Offset error	Deviation when the output should be at 0V.		—	1 mV
Bandwidth	Frequency response of the analog output		DC	7.2k Hz (3 db)

Table 31 - Linear Scaling Specifications

Drive Cat. No.	Speed rpm	Value V DC	Torque %
2094-xCxx-Mxx or 2094-xMxx	10,000	5.0	1000
	0	2.5	0
	-10,000	0	-1000
2094-xCxx-Mxx-S or 2094-xMxx-S	10,000	10.0	1000
	0	5.0	0
	-10,000	0	-1000

For configuration/set up of the analog outputs, refer to Configure Drive Parameters and System Variables beginning on [page 153](#).

Contactor Enable Relay

Contactor enable is a relay-driven contact used in the safety control string to protect the drive electronics during certain fault conditions. It is capable of handling 120V AC or 24V DC at 1 A or less. Contactor enable is a function of the converter and is not available in the axis modules. An active state indicates the drive is operational and does not have a fault.



ATTENTION: Wiring the contactor enable relay is required. To avoid personal injury or damage to the drive, wire the contactor enable relay into your safety control string so that:

- three-phase power is removed from the drive in the event of shutdown fault conditions.
- drive operation is prevented when the power rail is not fully populated.
- control power is applied to the drive prior to three-phase power.

Refer to IAM Module (without LIM module) on [page 204](#) for a wiring example.

IMPORTANT All power rail slots must have a module installed or the contactor enable relay will not close.

Figure 30 - Contactor Enable Relay Circuit

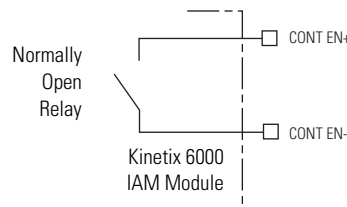


Table 32 - Contactor Enable Relay Output Specifications

Attribute	Value	Min	Max
On-state current	Current flow when the relay is closed	—	1 A
On-state resistance	Contact resistance when the relay is closed	—	1 Ω
Off-state voltage	Voltage across the contacts when the relay is open	—	120V AC or 24V DC

Power and Relay Specifications

This section provides a description of the Kinetix 6000 brake relay (BC), input power (IPD), motor power (MP), and control power (CPD) connectors.

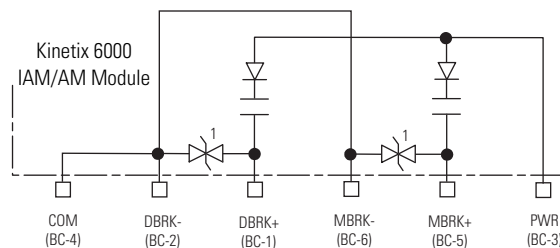
Motor/Resistive Brake Relay

Two connections are required for the (customer-supplied) motor/resistive brake input power (BC-3 and BC-4) and two connections each for the motor and resistive brake output, as shown in the figure below. Connections are rated for +24V and current as shown in the table below.

An active signal releases the motor brake (BC-5 and BC-6). The brake signal is the same as the contactor enable signal, with the addition of the turn-on and turn-off delays specified by the brake active delay and brake inactive delay (configurable in RSLogix 5000 software). Refer to Axis Module/Rotary Motor Wiring Examples beginning on [page 212](#) and Controlling a Brake Example on [page 224](#) for wiring examples.

The resistive brake relay (BC-1 and BC-2) controls the resistive brake module (RBM) contactor. The RBM module is wired between the drive and motor by using an internal contactor to switch the motor between the drive and a resistive load. The RBM module contact delay is the time it takes to fully close the contactor across the motor power input lines, and must be configured in RSLogix 5000 software. Refer to RBM Module Interconnect Diagrams beginning on [page 259](#) for wiring examples.

Figure 31 - Brake Relay Circuit



(1) Noise suppression device.

Table 33 - Brake Relay Output Specifications

Attribute	Description	IAM/AM Module	Value, Max Series A	Value, Max Series B
On-state current ⁽¹⁾	Current flow when the relay is closed	2094-AC05-Mxx-x, 2094-AC09-M02-x, 2094-AMP5-x, 2094-AM01-x, 2094-AM02-x	1.0 A	N/A
		2094-BC01-Mxx-x, 2094-BC02-M02-x, 2094-BMP5-x, 2094-BM01-x, 2094-BM02-x		3.0 A
		2094-AC16-M03-x, 2094-AC32-M05-x, 2094-AM03-x, 2094-AM05-x	1.3 A	N/A
		2094-BC04-M03-x, 2094-BC07-M05-x, 2094-BM03-x, 2094-BM05-x	3.0 A	3.0 A
On-state resistance	Contact resistance when the relay is closed		1 Ω	1 Ω
Off-state voltage	Voltage across the contacts when the relay is open		30V	30V

(1) For motors requiring more than the maximum current specified, a relay must be added.

Input Power Cycle Capability

The power cycle capability is inversely proportional to the system capacitance (including DC bus follower), but cannot exceed 2 contactor cycles per minute with up to 4 axes or 1 contactor cycle per minute with 5...8 axes.

The cycle capability also depends on the converter power rating and the total system capacitance. Refer to Appendix D on [page 245](#) to calculate total system capacitance.

Table 34 - Maximum Input Power Cycling Specifications (230V)

Attribute	2094-AC05-MP5-S	2094-AC05-M01-S	2094-AC09-M02-S	2094-AC16-M03-S	2094-AC32-M05-S
Main AC input power cycling (cycles per minute for 10,000 μ f)	0.69		4.30		

Table 35 - Maximum Input Power Cycling Specifications (460V)

Attribute	2094-BC01-MP5-S	2094-BC01-M01-S	2094-BC02-M02-S	2094-BC04-M03-S	2094-BC07-M05-S
Main AC input power cycling (cycles per minute for 10,000 μ f)	0.12		0.52	2.15	4.30

For example, in a 4 axis system with a 2094-BC02-M02-S IAM module and 2,000 μ F total capacitance, the calculated capability is $0.52 \times 10,000 / 2000 = 2.6$ cycles per minute. However, this value is reduced to 2.0 by the 4 axes per system limitation.

Peak Enhancement Specifications

Drives that support the Peak-enhanced mode have the capability of increasing the maximum inverter peak current to achieve greater overload performance.

IMPORTANT The peak enhancement feature requires the use of RSLogix 5000 software and drive firmware as specified in [Table 36](#).

Table 36 - Peak Enhancement Software and Firmware Requirements

IAM Module Cat. No.	AM Module Cat. No.	RSLogix 5000 Software Version	Kinetix 6000 Drive Firmware Revision
2094-BC01-MP5-S	2094-BMP5-S	16 or later	1.111 or later
2094-BC01-M01-S	2094-BM01-S	16 or later	1.111 or later
2094-BC02-M02-S	2094-BM02-S	16 or later	1.111 or later
2094-BC04-M03-S	2094-BM03-S	17 or later	1.117 or later
2094-BC07-M05-S	2094-BM05-S	17 or later	1.117 or later

Table 37 - Kinetix 6000 Inverter Peak Overload Support

Kinetix 6000 Drives Cat. No.	Module	Safe-off Drive	Series A	Series B
2094-BCxx-Mxx	IAM	Non Safe-off	Standard	Standard
2094-BMxx	AM			
2094-BCxx-Mxx-S	IAM	Safe-off	Standard	Standard or Peak Enhanced ⁽¹⁾
2094-BMxx-S	AM			

(1) Standard mode is enabled by default to preserve backward compatibility, but you can enable the Peak-enhanced mode to achieve increased peak current performance.

Table 38 - Kinetix 6000 Peak Current Ratings

IAM/AM Module Cat. No.	Peak Inverter Current Rating		Peak Converter Current Rating	
	Standard	Peak Enhanced	Series A	Series B
2094-BC01-MP5-S	150%	250%	200%	250%
2094-BC01-M01-S	150%	250%	200%	250%
2094-BC02-M02-S	150%	250%	200%	250%
2094-BC04-M03-S	150%	250%	200%	250%
2094-BC07-M05-S	150%	200%	200%	300%
2094-BMP5-S	150%	250%	N/A	N/A
2094-BM01-S	150%	250%	N/A	N/A
2094-BM02-S	150%	250%	N/A	N/A
2094-BM03-S	150%	250%	N/A	N/A
2094-BM05-S	150%	200%	N/A	N/A

Figure 32 - Load Duty-cycle Profile Example

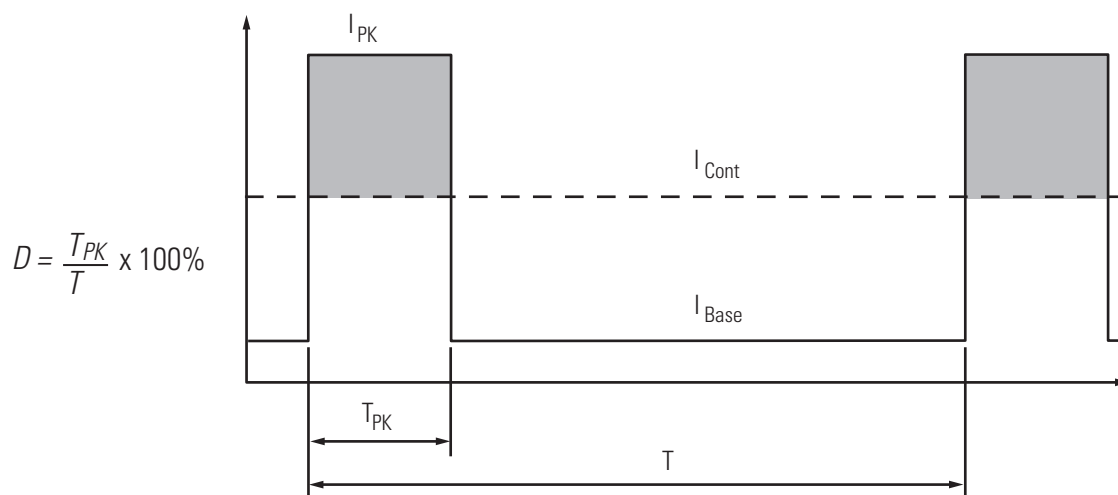
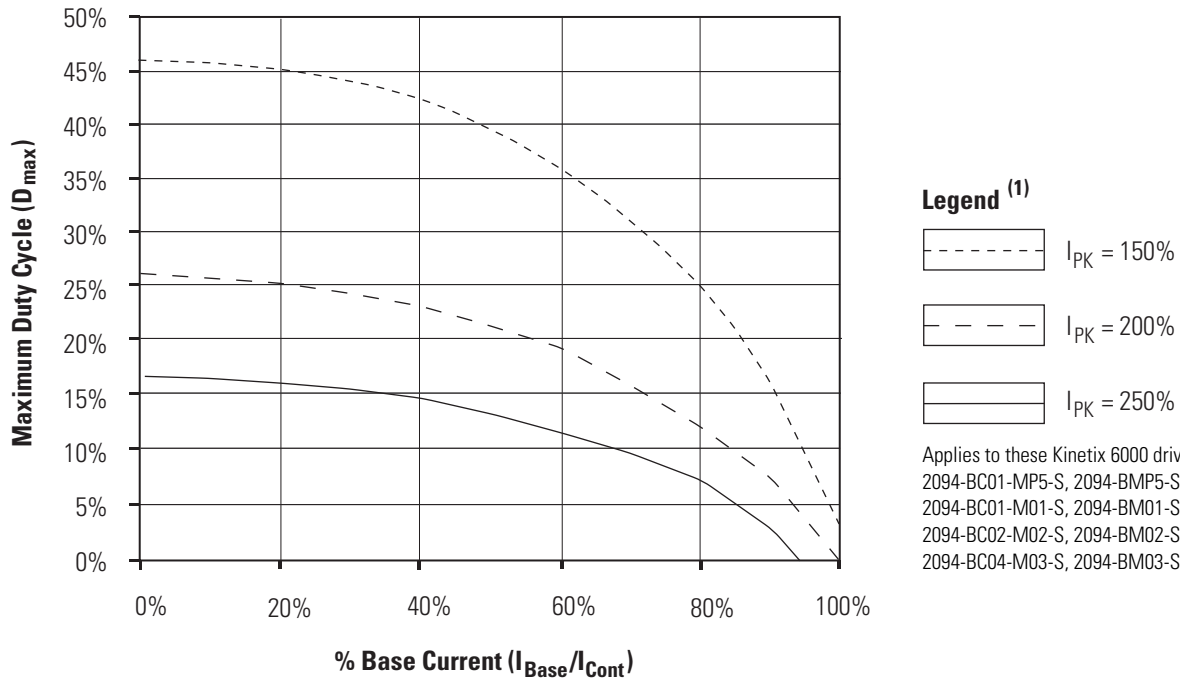


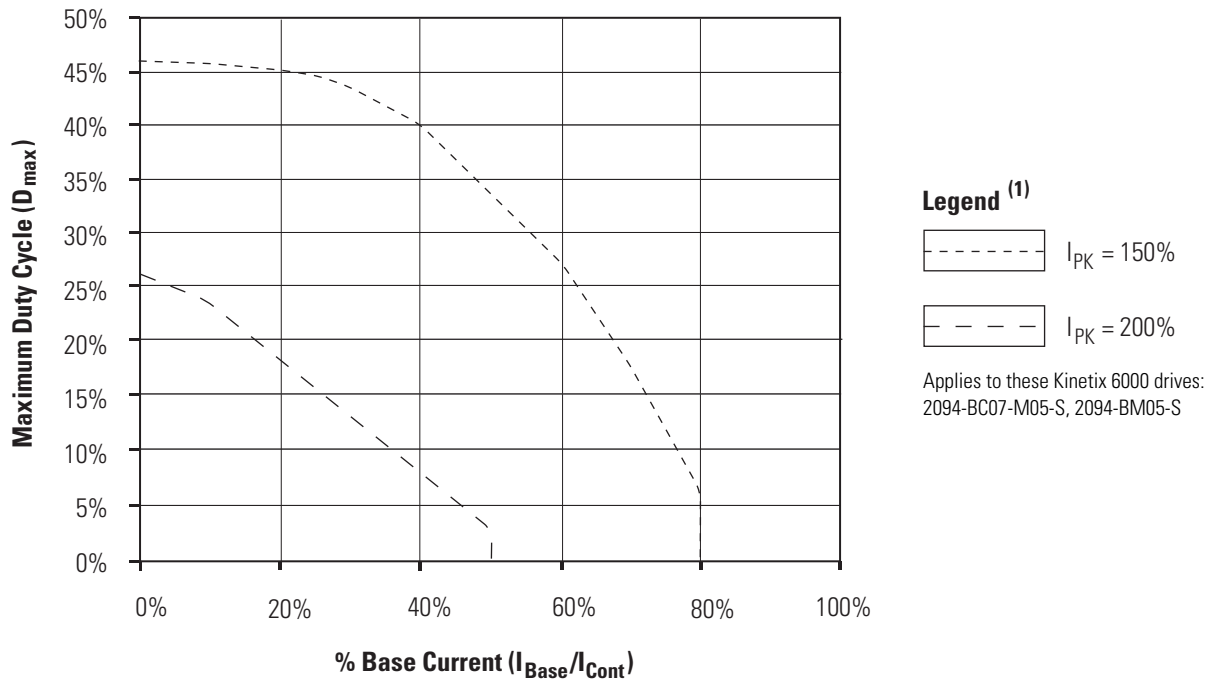
Table 39 - Peak Duty Cycle Definition of Terms

Term	Definition ⁽¹⁾
Continuous Current Rating (I_{Cont})	The maximum value of current that can be output continuously.
Peak Current Rating (I_{PKmax})	The maximum value of peak current that the drive can output. This rating is valid only for overload times less than T_{PKmax} .
Duty Cycle (D)	The ratio of time at peak to the Application Period and is defined as: $D = \frac{T_{PK}}{T} \times 100\%$
Time at Peak (T_{PK})	The time at peak current (I_{PK}) for a given loading profile. Must be less than or equal to T_{PKmax} .
Peak Current (I_{PK})	The level of peak current for a given loading profile. I_{PK} must be less than or equal to the Peak Current Rating (T_{PKMAX}) of the drive.
Base Current (I_{Base})	The level of current between the pulses of peak current for a given loading profile. I_{Base} must be less than or equal to the continuous current rating (I_{Cont}) of the drive.
Loading Profile	The loading profile is comprised of I_{PK} , I_{Base} , T_{PK} , and D (or T) values and completely specify the operation of the drive in an overload situation. These values are collectively defined as the Loading Profile of the drive.
Application Period (T)	The sum of the times at I_{PK} (T_{PK}) and I_{Base} .

(1) All current values are specified as RMS.

Figure 33 - Peak Inverter Overload ($T_{PK} < 2.0$ s)

(1) Base current (I_{Base}) and peak current (I_{PK}) are a percentage of the continuous drive current rating (I_{Cont}).

Figure 34 - Peak Inverter Overload ($T_{PK} < 2.0$ s)

(1) Base current (I_{Base}) and peak current (I_{PK}) are a percentage of the continuous drive current rating (I_{Cont}).

Control Power

The IAM module requires AC input power for logic circuitry.

IMPORTANT The control power input requires an AC (EMC) line filter for CE certification. For wiring examples, refer to Power Wiring Examples beginning on [page 201](#).

IMPORTANT Control power isolation, via a step-down transformer, is required for all 460V applications. Source the 2094-ACxx-Mxx-x (230V) IAM module control power from the three-phase input power (line-to-line). Supplying control power from any other source requires an isolation transformer. Do not ground the transformer secondary to avoid ground fault conflicts with IAM module. Also, see Transformer Specifications for Control Power Input on [page 188](#).

The National Electrical Code and local electrical codes take precedence over the values and methods provided. Implementation of these codes is the responsibility of the machine builder.

Table 40 - Control Power Input Power Specifications

Attribute	Value
Input voltage	95...264V AC rms, single-phase
Input power frequency	47...63 Hz
Control power AC input current Nom @ 220/230V AC rms Nom @ 110/115V AC rms Max inrush (0-pk)	3 A 6 A 98 A ⁽¹⁾

(1) For eight axis systems with 230V AC control input voltage and 50 °C (122°F) ambient temperature the maximum inrush duration is less than 1/2 line cycle. Use this equation to calculate maximum inrush current for systems with different axis count and control input voltage.

$$I_{PK} = 0.043 \times (V_{IN}) + 6.72 \times (\# \text{ of axes}) + 0.000333 \times (V_{IN}^2) - 0.816 \times (\# \text{ of axes})^2 + 0.0358 \times (\# \text{ of axes} \times V_{IN})$$

Table 41 - Control Power Current Requirements

Modules on Power Rail	110/115V AC Input A	220/230V AC Input A	Input VA VA
IAM only	0.75	0.35	150
IAM and 1 AM	1.50	0.70	200
IAM and 2 AM	2.25	1.0	275
IAM and 3 AM	3.0	1.35	350
IAM and 4 AM	3.75	1.70	450
IAM and 5 AM	4.50	2.0	550
IAM and 6 AM	5.25	2.40	650
IAM and 7 AM	6.0	3.0	750

Feedback Specifications

The IAM and AM modules can accept motor and auxiliary feedback signals from these types of encoders:

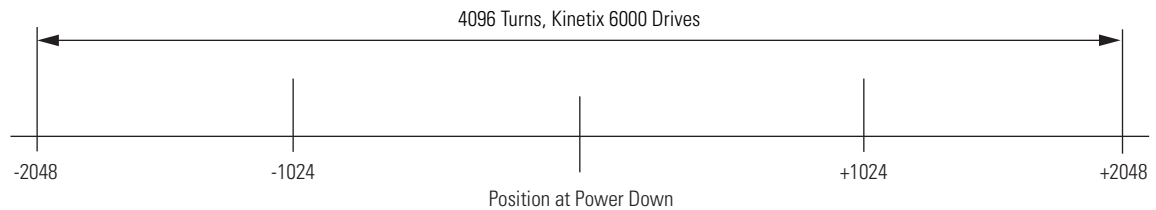
- Stegmann Hiperface
- TTL or Sine/Cosine with index pulse and Hall commutation
- Resolver Transmitter TR = 0.25 (motor feedback only)

Motor feedback from Heidenhain EnDat high-resolution encoders is also accepted, but only when using drive firmware revision 1.116 and the 2090-K6CK-KENDAT low-profile feedback module for EnDat to Hiperface conversion.

Absolute Position Feature

The drive's absolute position feature tracks the position of the motor, within ± 2048 turns, while the drive is powered off. The absolute position feature is available with only multi-turn (-M or -V) encoders, for example, motor catalog number MPL-B310P-M.

Figure 35 - Absolute Position Retention Limit



Motor Feedback Specifications

AM, BM, and IM input encoder signals are filtered by using analog and digital filtering. The inputs also include illegal state change detection.

Figure 36 - AM, BM, and IM Motor Encoder Input Circuits

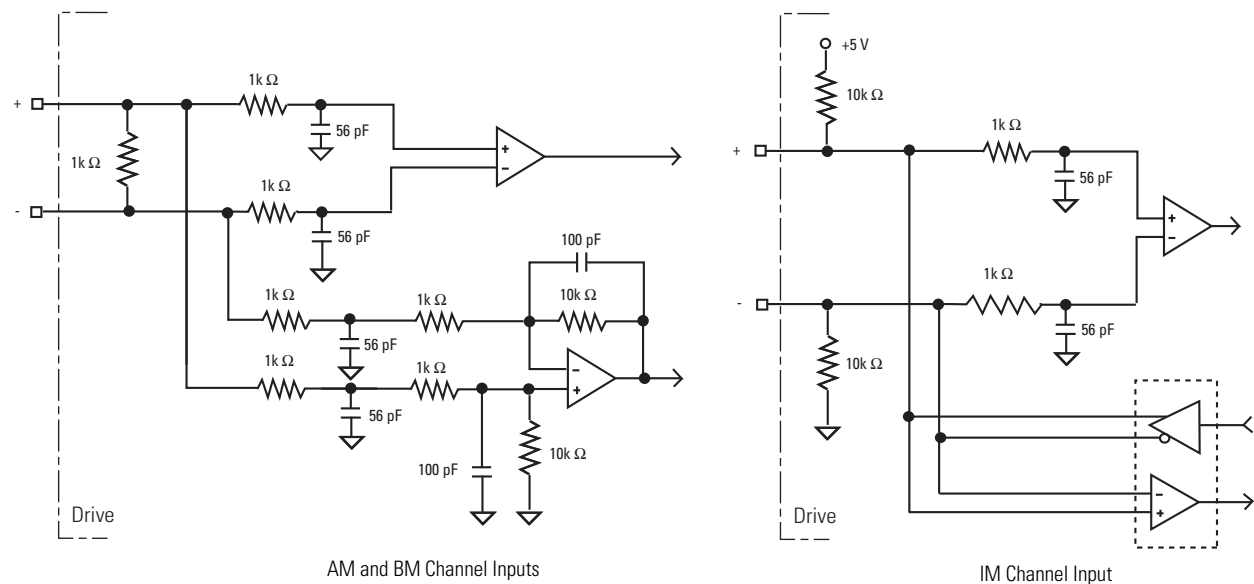


Table 42 - Motor Encoder Feedback Specifications

Specification	Description
Encoder types	Incremental, A quad B, sine/cosine, intelligent, resolver, and absolute
Maximum input frequency	5.0 MHz (TTL input) per channel
	250 kHz (sine/cosine input)
Commutation feedback	Hall sensor

Table 43 - AM, BM, and IM Input Specifications for TTL Encoders

Parameter	Description	Min	Max
AM, BM, and IM On-state input voltage	Input voltage difference between the plus (+) input and the minus (-) input that is detected as an on-state.	+1.0V	+7.0V
AM, BM, and IM Off-state input voltage	Input voltage difference between the plus (+) input and the minus (-) input that is detected as an off-state.	-1.0V	-7.0V
Common mode input voltage	Potential difference between any encoder signal and logic ground.	-7.0V	+12.0V
DC current draw	Current draw into the + or - input.	-30 mA	30 mA
AM, BM input signal frequency	Frequency of the AM or BM signal inputs. The count frequency is 4 times this frequency, because the circuitry counts all four transitions.	—	500 kHz
IM pulse width	Pulse width of the index input signal. Because the index is active for a percentage of a revolution, the speed will determine the pulse width.	125 nS	—
AM, BM phase error 2.5 MHz line frequency	Amount that the phase relationship between the AM and BM inputs can deviate from the nominal 90°.	-22.5°	+22.5°
AM, BM phase error 1 MHz line frequency	Amount that the phase relationship between the AM and BM inputs can deviate from the nominal 90°.	-45°	+45°

Table 44 - AM, BM, and IM Input Specifications for Sine/Cosine Encoders

Parameter	Description	Min	Max
Sine/cosine input signal frequency	Frequency of the Sine or Cosine signal inputs.	—	250 kHz
Sine/cosine input voltage	Peak-to-peak input voltages of the Sine or Cosine inputs.	0.8V (p-p)	1.2V (p-p)

Table 45 - Specifications for Heidenhain EnDat Encoders

Command Set	Order Designation	Description
EnDat 2.2	EnDat 01	1V p-p Sin/Cos, <2 MHz clock frequency

Feedback Power Supply Specifications

The IAM and AM power circuit board generates +5V and +9V DC for motor and auxiliary feedback power. Short circuit protection and separate common mode filtering for each channel is included.

Supply	Reference	Voltage			Current mA	
		Min	Nominal	Max	Min	Max
+5V DC	EPWR_5V	4.9	5.25	5.4	0	400
+9V DC	EPWR_9V	8.3	9.1	9.9	0	275

Auxiliary Position Feedback Encoders

Allen-Bradley Bulletin 842HR, 844D, 845H, and 845T encoders are the preferred encoders for auxiliary feedback connections.

Cat. No.	Description
842HR-MJDZ115FWYD (multi-turn) 842HR-SJDZ115FWYD (single-turn)	Size 25, sine/cosine, square flange, 3/8 in. shaft, 5V or 9V DC, digital RS-485 interface, M23 17-pin connector
844D-B5CC1FW	Size 20, incremental, square flange, 3/8 in. shaft, 5V DC, 5V DLD output, radial connector
844D-B5CC1CS	
844D-B5CC1DR	
845H-SJDN14FWY2	Size 25, incremental, square flange, 3/8 in. shaft, 5V DC, 5V DLD output, radial connector
845H-SJDN14CSY2	
845H-SJDN14DRY2	
845T-DN13EFW	HS35, hollow shaft incremental, 5/8 in. shaft, tether 3/8 in. bolt on, 5V DC, 5V DLD output, 10 pin connector
845T-DN13ECS	

Refer to the Kinetix Motion Control Selection Guide, publication [GMC-SG001](#), for more information on these Allen-Bradley encoders.

Connecting the Kinetix 6000 Drive System

Introduction

This chapter provides procedures for wiring your Kinetix 6000 system components and making cable connections.

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Grounding the Kinetix 6000 Drive System	89
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Basic Wiring Requirements

This section contains basic wiring information for the Kinetix 6000 drive modules.



ATTENTION: Plan the installation of your system so that you can perform all cutting, drilling, tapping, and welding with the system removed from the enclosure. Because the system is of the open type construction, be careful to keep any metal debris from falling into it. Metal debris or other foreign matter can become lodged in the circuitry, which can result in damage to components.



SHOCK HAZARD: To avoid hazard of electrical shock, perform all mounting and wiring of the Bulletin 2094 power rail and drive modules prior to applying power. Once power is applied, connector terminals may have voltage present even when not in use.

IMPORTANT This section contains common PWM servo system wiring configurations, size, and practices that can be used in a majority of applications. National Electrical Code, local electrical codes, special operating temperatures, duty cycles, or system configurations take precedence over the values and methods provided.

Building Your Own Cables

IMPORTANT Factory-made cables are designed to minimize EMI and are recommended over hand-built cables to optimize system performance.

- Connect the cable shield to the connector shells on both ends of the cable with a complete 360° connection.
- Use twisted pair cable whenever possible. Twist differential signals with each other and twist single-ended signals with the appropriate ground return.

Refer to the Kinetix Motion Control Selection Guide, publication [GMC-SG001](#), for low-profile connector kit, drive-end (mating) connector kit, and motor-end connector kit catalog numbers.

Routing the Power and Signal Cables

Be aware that when you route power and signal wiring on a machine or system, radiated noise from nearby relays, transformers, and other electronic drives can be induced into motor or encoder feedback signals, input/output communication, or other sensitive low voltage signals. This can cause system faults and communication anomalies.

Refer to Electrical Noise Reduction on [page 31](#) for examples of routing high and low voltage cables in wireways. Refer to the System Design for Control of Electrical Noise Reference Manual, publication [GMC-RM001](#), for more information.

Determine the Input Power Configuration

Before wiring input power to your Kinetix 6000 system, you must determine the type of input power you are connecting to. The IAM module is designed to operate in both grounded and ungrounded environments.



ATTENTION: When using a LIM module with your IAM module, the VAC LINE input power must come from a grounded configuration (refer to the figure below).

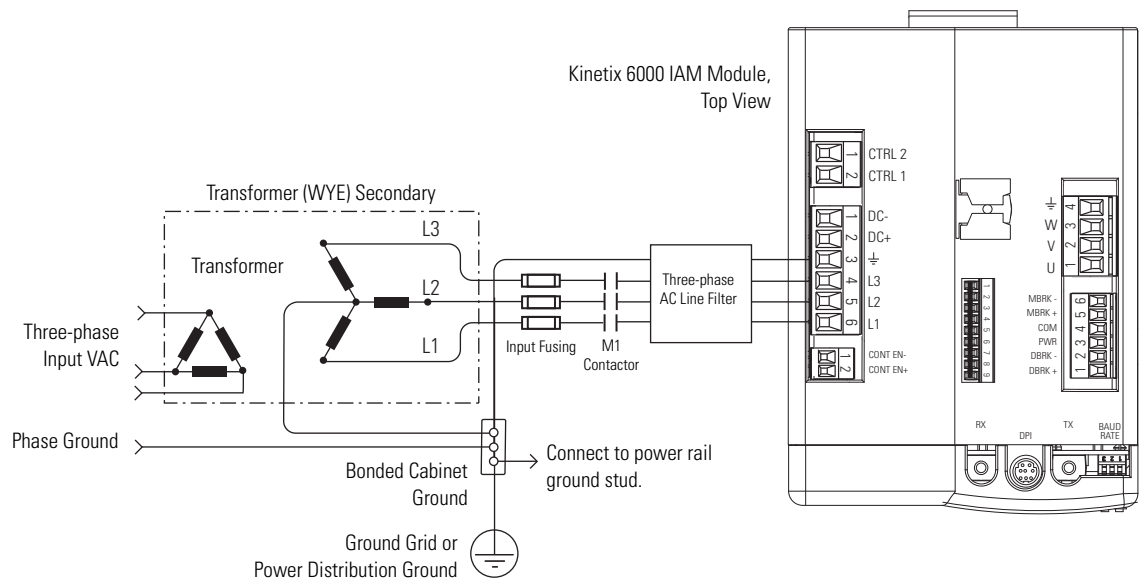
When not using a LIM module with your IAM module, ungrounded configurations are permitted, but you must set the jumper to prevent high electrostatic build-up.

Refer to Setting the Ground Jumper in Ungrounded Power Configurations on [page 83](#) for more information.

Grounded Power Configurations

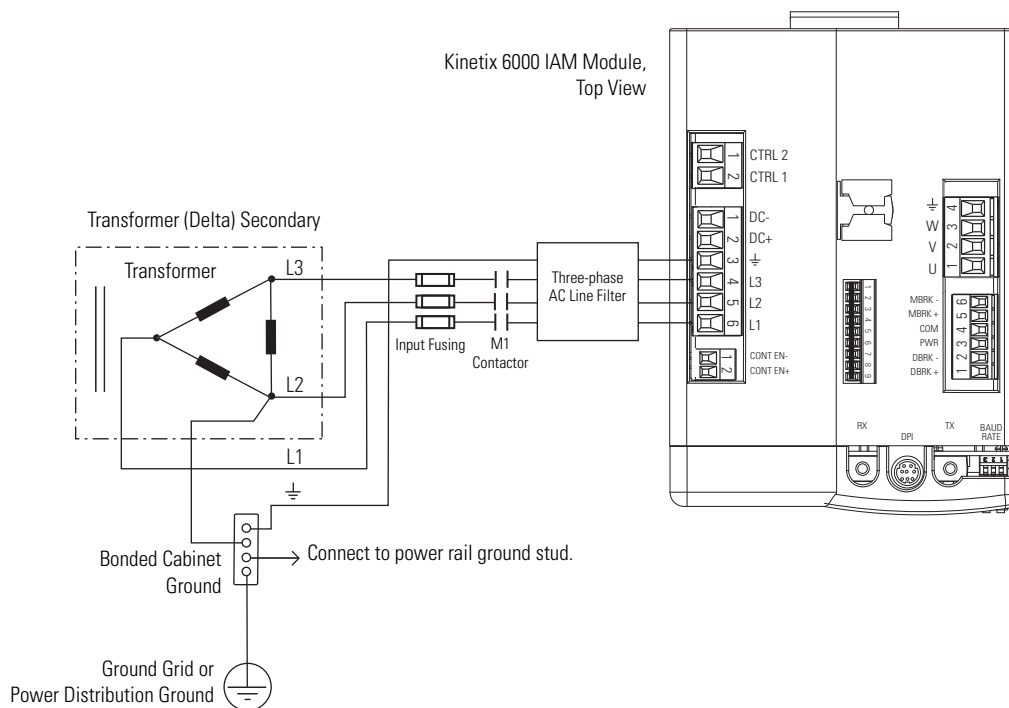
The grounded (WYE) power configuration lets you ground your three-phase power at a neutral point. This type of grounded power configuration is preferred.

Figure 37 - Grounded Power Configuration (WYE Secondary)



Refer to Power Wiring Examples beginning on [page 201](#) for input power interconnect diagrams with and without the LIM module.

Figure 38 - Grounded (B-Phase) Power Configuration (Delta Secondary)



The IAM module has a factory-installed ground jumper configured for grounded power distribution.

IMPORTANT If you determine that you have grounded power distribution in your plant, you do not need to modify your IAM module.

Refer to Power Wiring Examples beginning on [page 201](#) for input power interconnect diagrams with and without the LIM module.

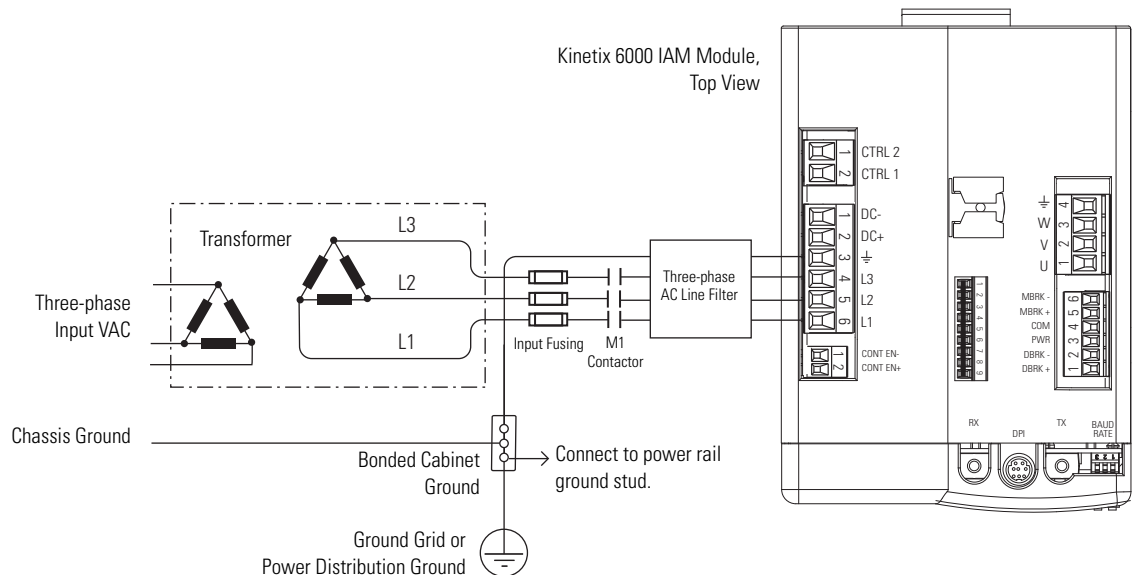
Ungrounded Power Configurations

Ungrounded power configurations are allowed, but you must jumper across a 120 k Ω resistor (internal to the IAM module) to prevent high electrostatic build-up. The ungrounded power configuration (shown below) does not provide a neutral ground point. The IAM module has a ground jumper set for grounded power distribution (default configuration).

IMPORTANT If you determine that you have ungrounded or high-impedance grounded power distribution in your facility, you need to move the default jumper (configured for grounded power) to the ungrounded power position to prevent electrostatic buildup inside the IAM module.

Refer to Setting the Ground Jumper in Ungrounded Power Configurations on [page 83](#) for more information.

Figure 39 - Ungrounded Power Configuration



ATTENTION: Ungrounded systems do not reference each phase potential to a power distribution ground. This can result in an unknown potential to earth ground.

Refer to Power Wiring Examples beginning on [page 201](#) for input power interconnect diagrams with and without the LIM module.

DC Common Bus Configurations

When the IAM module is used in a DC common-bus configuration, the IAM module is known as a leader IAM or follower IAM module. The IAM (non-common bus) and leader IAM module have identical three-phase input power connections. The leader IAM module is responsible for discharging the DC bus, and for providing common-bus follower drives with DC bus pre-charge, bus regulation, phase-loss detection, and ground fault detection. Follower IAM modules do not have three-phase input power connections, but have DC bus connections from a leader IAM module.

Table 46 - IAM Module Terminology and Use

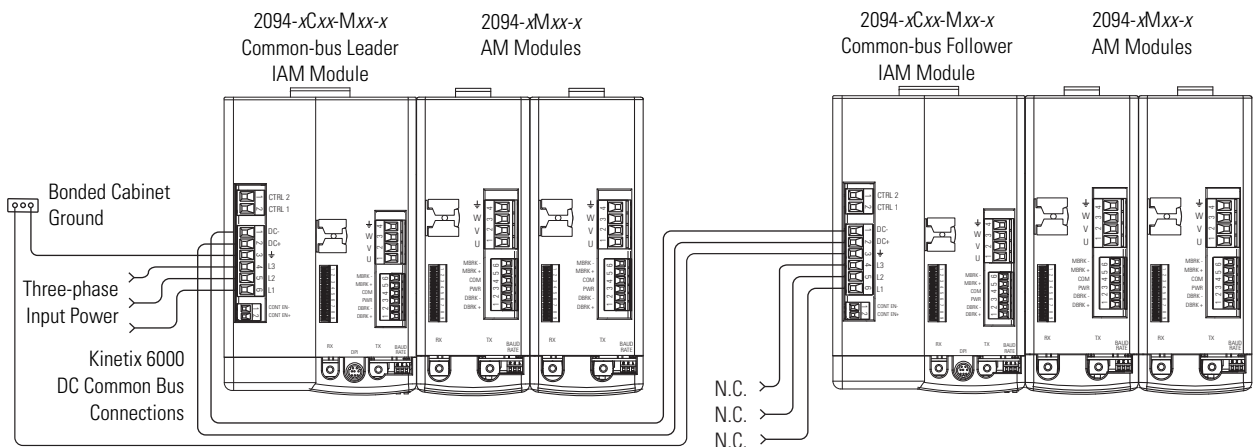
This Module	Is Wired	And is
IAM	With three-phase input power.	Not wired in Common-bus mode.
Leader IAM	With three-phase input power, but has DC common-bus connections to a follower IAM module.	Wired in Common-bus mode.
Follower IAM	Without three-phase input power, but has DC common-bus connections from a leader IAM module.	Wired in Common-bus mode and configured by using RSLogix 5000 software.

IMPORTANT Use Kinetix 6000 drive firmware revision 1.85 and RSLogix 5000 software version 15 or later, for common-bus power configurations.

The Kinetix 6000 leader IAM module can operate with non-Kinetix 6000 follower drives, as can the Kinetix 6000 follower IAM module operate with non-Kinetix 6000 common-bus leader drives. However, non-Kinetix 6000 leader and follower drives must meet the same functional requirements as the Kinetix 6000 leader and follower IAM modules.

IMPORTANT Any non-Kinetix 6000 common-bus leader IAM module that does not provide pre-charge is required to add an additional external pre-charge circuit before connecting to any Kinetix 6000 common-bus follower IAM module.

Figure 40 - Typical DC Common-bus Configuration



Common Bus Fusing Requirements

When using a Kinetix 6000 leader IAM module, DC-bus fuses are required only when wiring to more than one Kinetix 6000 follower IAM module. When wiring multiple follower IAM modules, terminal blocks are required to extend the DC common-bus power to additional drives. You should install fuses in both lines of the DC bus between the DC bus terminal block and each follower IAM module. These fuses should be rated based on the DC input current of each follower IAM module.

When using a non-Kinetix 6000 common-bus leader drive, DC bus fuses are required in both lines of the DC bus, between the common-bus leader drive and follower IAM module. These fuses should be rated based on the common-bus leader drive DC output current. When using more than one follower IAM module, fuses should be installed in both lines of the DC bus between the non-Kinetix 6000 common-bus leader and the terminal block as well as between the DC bus terminal block and each follower IAM module.

Refer to Circuit Breaker/Fuse Specifications on [page 187](#) for recommended fuse sizes. Refer to DC Common Bus Wiring Examples on [page 205](#) for interconnect diagrams.

Setting the Ground Jumper in Ungrounded Power Configurations

Setting the ground jumper is necessary only when using an ungrounded or high-impedance grounded power configuration. Setting the jumper involves removing the IAM module from the power rail, opening the IAM module, and moving the jumper.

IMPORTANT If you have grounded power distribution, you do not need to set the ground jumper. Go to Grounding the Kinetix 6000 Drive System on [page 89](#).

Setting the ground jumper is best done when the IAM module is removed from the power rail and placed face-up on a solid surface equipped as a grounded static-safe workstation.



ATTENTION: To avoid personal injury and/or damage to equipment, remove the IAM module from the power rail before setting the ground jumper.

By setting the ground jumper for ungrounded power configurations, you no longer maintain line-to-neutral voltage protection.

To remove the IAM module from the power rail, refer to Remove Kinetix 6000 Drive Modules on [page 174](#).



ATTENTION: This drive contains electrostatic discharge (ESD) sensitive parts and assemblies. You are required to follow static-control precautions when you install, test, service, or repair this assembly. If you do not follow ESD control procedures, components can be damaged. If you are not familiar with static control procedures, refer to Guarding Against Electrostatic Damage, publication [8000-4.5.2](#), or any other applicable ESD awareness handbook.

When using ungrounded input power in common-bus configurations, use this table to determine where to set the ground jumper.

Table 47 - Ground Jumper to Set

Leader Drive	Follower Drive	Set the Jumper in This Drive
Kinetix 6000 IAM module	Kinetix 6000 IAM module	Leader drive
Kinetix 6000 IAM module	Non-Kinetix 6000 drive	Leader drive
Non-Kinetix 6000 drive	Kinetix 6000 IAM module	Follower drive (if no setting exists in the leader drive)

Set the Ground Jumper

Follow these steps to set the ground jumper for ungrounded power.

1. Remove the top and bottom front-panel screws.
Refer to the figures beginning on [page 86](#) (230V IAM module) or [page 87](#) (460V IAM module) for an illustration of your actual hardware.
2. Swing the front panel open to the right, as shown, and locate the ground jumper.

IMPORTANT Do not attempt to remove the front panel from the IAM module. The front panel status indicators and switches are also connected to the IAM module with a ribbon cable. The ribbon cable will act like a hinge and let you swing the front panel open and access the ground jumper.

3. Move the ground jumper.

IAM Module (series A)	Configuration	
	Grounded (default)	Ungrounded
2094-ACxx-Mxx-x (230V)	P15 and P16	P15 and P17
2094-BC01-MP5-x (460V)	P13 and P14	P13 and P12
2094-BC01-M01-x (460V)		
2094-BC02-M02-x (460V)		
2094-BC04-M03-x (460V)	P14 and P13	P14 and P12
2094-BC07-M05-x (460V)		

IAM Module (series B)	Configuration	
	Grounded (default)	Ungrounded
2094-BC01-MP5-S (460V)	P16 and P17	P18 and P19
2094-BC01-M01-S (460V)		
2094-BC02-M02-S (460V)		
2094-BC04-M03-S (460V)		
2094-BC07-M05-S (460V)		

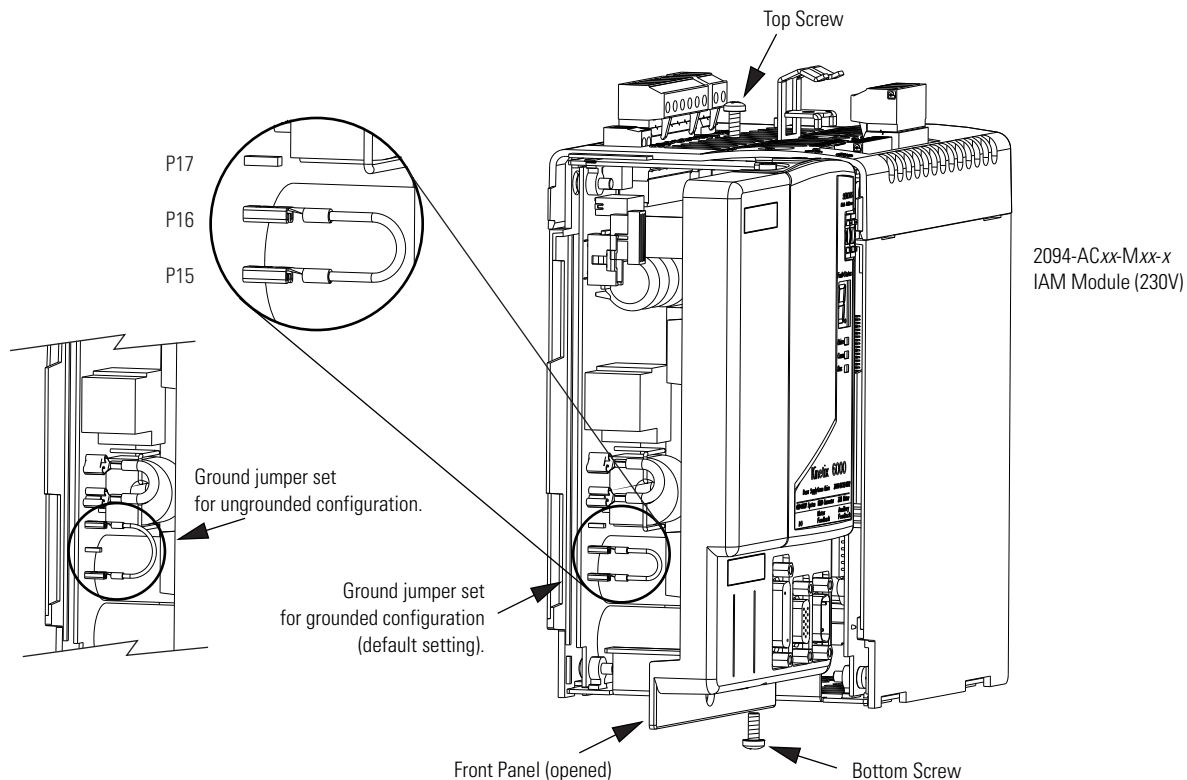
4. Replace the IAM module front panel and two screws.

Apply 1.6 N•m (14 lb•in) torque.

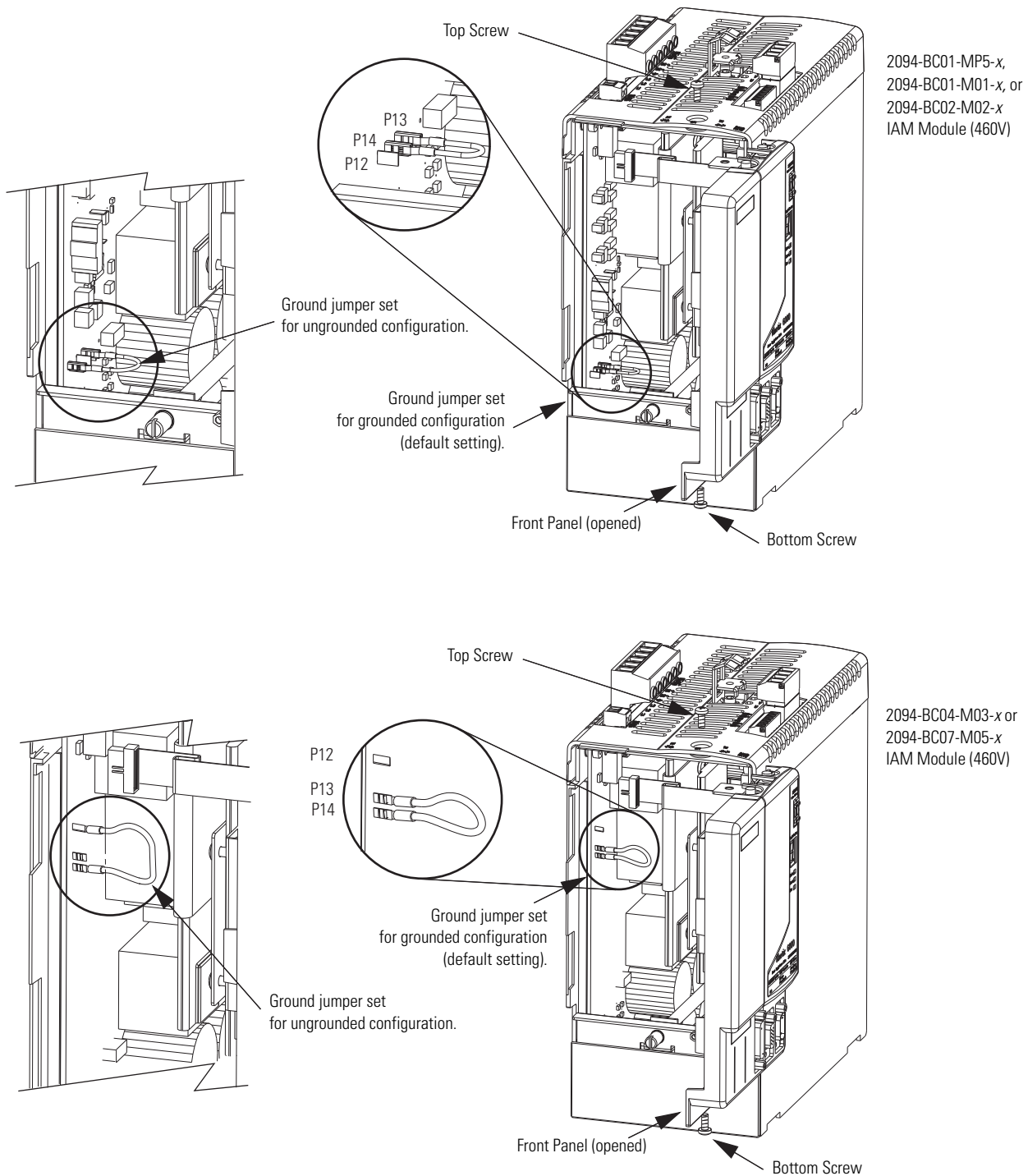
5. Mount the IAM module back on the power rail.

Refer to Replace Kinetix 6000 Drive Modules on [page 175](#).

Figure 41 - Setting the Ground Jumper (230V Series-A IAM modules)

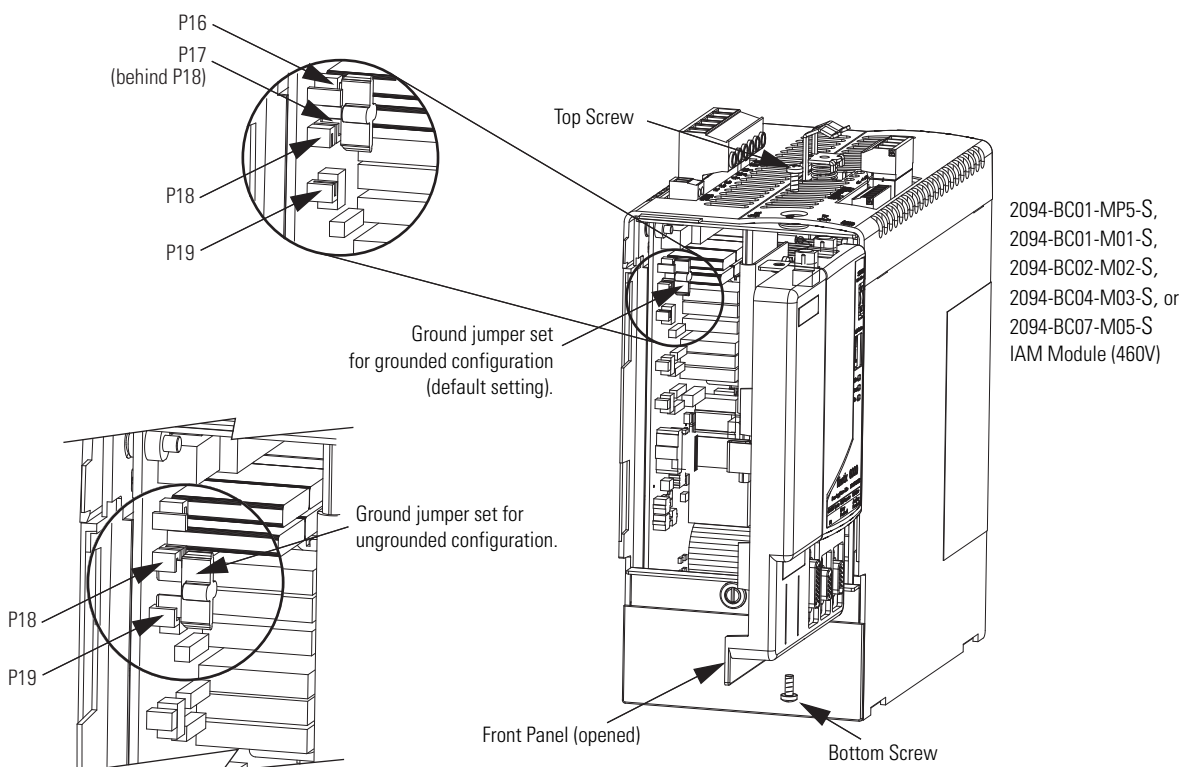


IMPORTANT Use the default jumper setting or remove the jumper entirely for grounded power configurations. Move the jumper, as shown above, for ungrounded power.

Figure 42 - Setting the Ground Jumper (460V Series-A IAM modules)

IMPORTANT Use the default jumper setting or remove the jumper entirely for grounded power configurations. Move the jumper, as shown above, for ungrounded power.

Figure 43 - Setting the Ground Jumper (460V Series-B IAM modules)



Grounding the Kinetix 6000 Drive System

All equipment and components of a machine or process system should have a common earth ground point connected to chassis. A grounded system provides a ground path for short circuit protection. Grounding your modules and panels minimize shock hazard to personnel and damage to equipment caused by short circuits, transient overvoltages, and accidental connection of energized conductors to the equipment chassis.



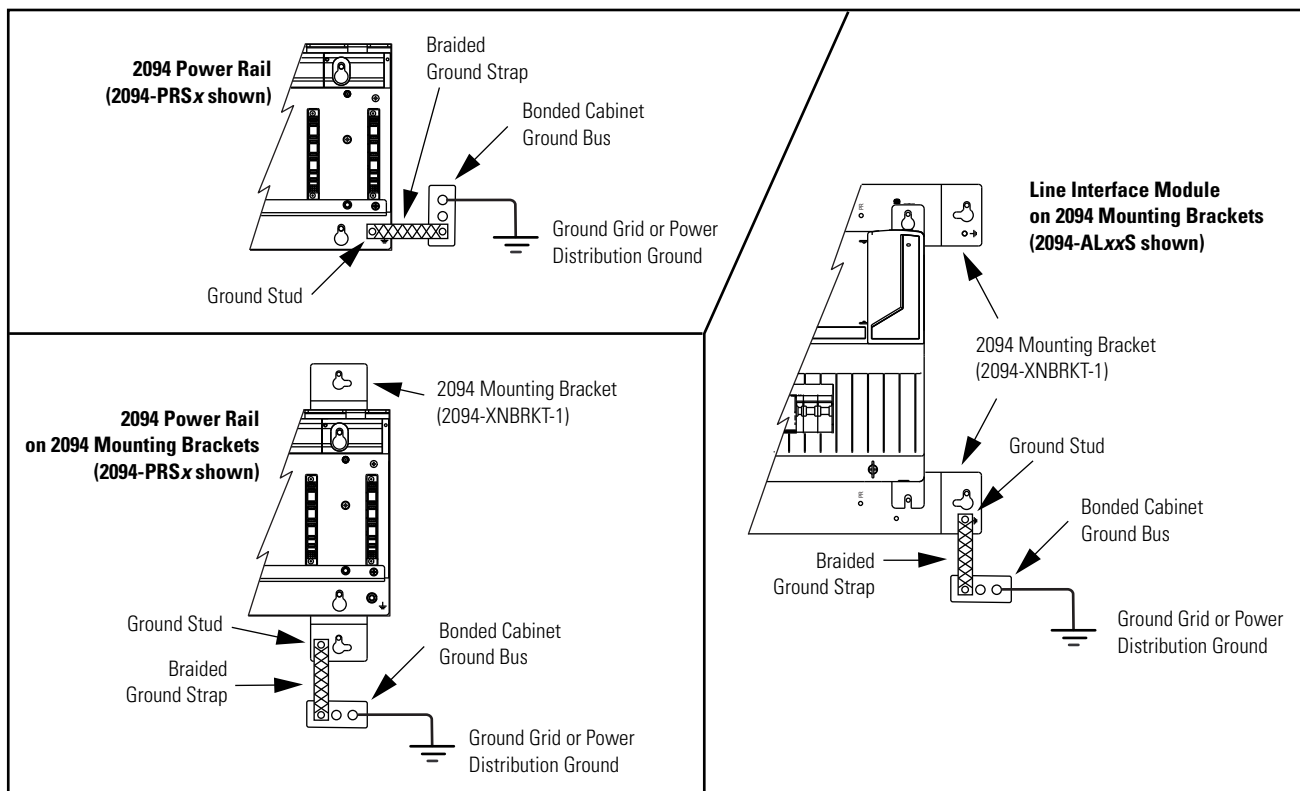
ATTENTION: The National Electrical Code contains grounding requirements, conventions, and definitions. Follow all applicable local codes and regulations to safely ground your system.

For CE grounding requirements, refer to Agency Compliance on [page 21](#).

Ground the Power Rail to the System Subpanel

The 2094-PR x and 2094-PRS x power rail ships with a braided ground strap, 100 mm (3.9 in.), that connects to the bonded cabinet ground bus. Connect the other end to either the power rail ground stud or mounting bracket ground stud, if mounting brackets are used.

Figure 44 - Connecting the Braided Ground Strap Examples



For power rail dimensions, refer to the Kinetix 6000 Power Rail Installation Instructions, publication [2094-IN003](#).

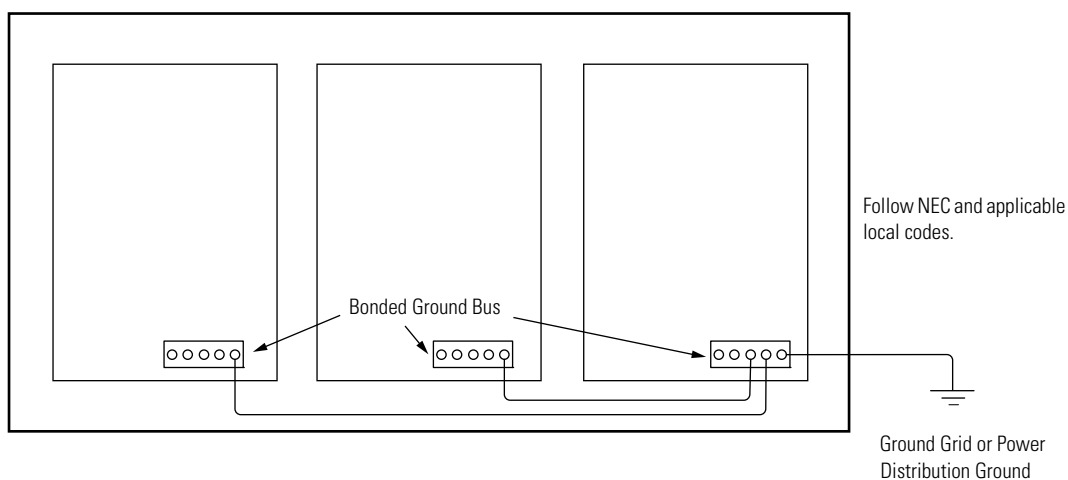
For mounting bracket dimensions, refer to the 2094 Mounting Brackets Installation Instructions, publication [2094-IN008](#).

IMPORTANT When 2094 mounting brackets are used to mount the power rail or LIM module over the AC line filter, the braided ground strap must be removed from the power rail and attached to a mounting bracket ground stud.

Ground Multiple Subpanels

In this figure, the chassis ground is extended to multiple subpanels.

Figure 45 - Subpanels Connected to a Single Ground Point



High-frequency (HF) bonding is not illustrated. For HF bonding information, refer to Bonding Multiple Subpanels on [page 33](#).

Power Wiring Requirements

Wire should be copper with 75 °C (167 °F) minimum rating. Phasing of main AC power is arbitrary and earth ground connection is required for safe and proper operation.

Refer to Power Wiring Examples on [page 201](#) for interconnect diagrams.

IMPORTANT The National Electrical Code and local electrical codes take precedence over the values and methods provided.

Table 48 - IAM Power Wiring Requirements

Kinetix 6000 Drive Cat. No.	Description	Connects to Terminals		Recommended Wire Size mm ² (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
		Pin	Signal			
2094-AC05-Mxx-x	DC bus ⁽¹⁾ and VAC input power	IPD-1 IPD-2 IPD-3 IPD-4 IPD-5 IPD-6	DC- DC+ $\frac{+}{-}$ L3 L2 L1	6...2.5 (10...14)	10 (0.38)	0.5...0.6 (4.4...5.3)
2094-AC09-M02-x				6...4 (10...12)		
2094-AC16-M03-x				30...10 (3...8)	16 (0.63)	2.4...3.0 (21.6...26.5)
2094-AC32-M05-x				30 (3)		
2094-BC01-Mxx-x 2094-BC02-M02-x				10...2.5 (8...14)	10 (0.38)	1.2...1.5 (10.6...13.2)
2094-BC04-M03-x				10...6 (8...10)	16 (0.63)	2.4...3.0 (21.6...26.5)
2094-BC07-M05-x				30 (3)		
2094-xCxx-Mxx-x	Control input power	CPD-1	CTRL 2	4...2.5 (12...14)	10 (0.38)	0.5...0.6 (4.4...5.3)
		CPD-2	CTRL 1			
	Contactor Enable	CED-1	CONT EN-	4...2.5 (12...14) ⁽²⁾		0.5...0.6 (4.4...5.3)
		CED-2	CONT EN+			

(1) DC common-bus connections (leader IAM to follower IAM module) should be kept as short as possible.

(2) The actual gauge of the contactor enable wiring depends on the system configuration. Consult your machine builder, the NEC, and applicable local codes.



ATTENTION: To avoid personal injury and/or equipment damage, make sure installation complies with specifications regarding wire types, conductor sizes, branch circuit protection, and disconnect devices. The National Electrical Code (NEC) and local codes outline provisions for safely installing electrical equipment.

To avoid personal injury and/or equipment damage, make sure motor power connectors are used for connection purposes only. Do not use them to turn the unit on and off.

To avoid personal injury and/or equipment damage, make sure shielded power cables are grounded to prevent potentially high voltages on the shield.

Table 49 - IAM/AM Power Wiring Requirements

Kinetix 6000 Drive Cat. No.	Description	Connects to Terminals		Recommended Wire Size mm ² (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
		Pin	Signal			
2094-AC05-Mxx-x, 2094-AC09-M02-x, 2094-BC01-Mxx-x, 2094-BC02-M02-x, 2094-AMP5-x, 2094-AM01-x, 2094-AM02-x, 2094-BMP5-x, 2094-BM01-x, 2094-BM02-x	Motor power	MP-4 MP-3 MP-2 MP-1	 W V U	Motor power cable depends on motor/drive combination. 6...1.5 (10...16)	10 (0.38)	0.5...0.6 (4.4...5.3)
2094-AC16-M03-x, 2094-AC32-M05-x, 2094-BC04-M03-x, 2094-AM03-x, 2094-AM05-x, 2094-BM03-x				10...1.5 (8...16)	10 (0.38)	1.2...1.5 (10.6...13.2)
2094-BC07-M05-x, 2094-BM05-x				30...2.5 (3...14)	16 (0.63)	2.4...3.0 (21.6...26.5)
IAM or AM (230 or 460V) 2094-xCxx-Mxx-x and 2094-xMxx-x	Brake power	BC-6 BC-5 BC-4 BC-3 BC-2 BC-1	MBRK- MBRK+ COM PWR DBRK- DBRK+	0.75 (18)	10 (0.38)	0.22...0.25 (1.9...2.2)
IAM or AM (230 or 460V) 2094-xCxx-Mxx-S and 2094-xMxx-S	Safe-off	SO-1 SO-2 SO-3 SO-4 SO-5 SO-6 SO-7 SO-8 SO-9 N/A N/A	FDBK2+ FDBK2- FDBK1+ FDBK1- SAFETY ENABLE2+ SAFETY ENABLE- SAFETY ENABLE1+ 24V + 24V_COM	0.75 (18) (stranded wire with ferrule) 1.5 (16) (solid wire)	7.0 (0.275)	0.235 (2.0)

Table 50 - Shunt Module Power Wiring Requirements

Cat. No.	Description	Connects to Terminals		Recommended Wire Size mm ² (AWG)	Torque Value N•m (lb•in)
		Pin	Signal		
2094-BSP2 Shunt module (230/460V)	1394-SRxxxx External passive shunt module	RC-1	DC+	10 (8) ⁽¹⁾	1.2...1.5 (10.6...13.2)
		RC-2	INT		
		RC-3	COL		
	Thermal switch	TS-1	TS1	0.75 (18)	0.22...0.25 (1.9...2.2)
		TS-2	TS2		

(1) 105 °C (221 °F), 600V.

Power Wiring Guidelines

Use these guidelines as a reference when wiring the power connectors on your IAM and AM drive modules.

IMPORTANT For connector locations of the Kinetix 6000 drive modules, refer to IAM/AM Module Features on [page 54](#).
When tightening screws to secure the wires, refer to the tables beginning on [page 91](#) for torque values.
When removing insulation from wires, refer to the tables beginning on [page 91](#) for strip lengths.

IMPORTANT To improve system performance, run wires and cables in the wireways as established in Establishing Noise Zones on [page 34](#).

Follow these steps when wiring the connectors on your IAM and AM drive modules.

1. Prepare the wires for attachment to each connector plug by removing insulation equal to the recommended strip length.

IMPORTANT Use caution not to nick, cut, or otherwise damage strands as you remove the insulation.

2. Route the cable/wires to your IAM and AM drive modules.
3. Insert wires into connector plugs.
Refer to connector pinout tables in [Chapter 4](#) or the interconnect diagrams in [Appendix B](#).
4. Tighten the connector screws.
5. Gently pull on each wire to make sure it does not come out of its terminal; reinsert and tighten any loose wires.
6. Insert the connector plug into the module connector.

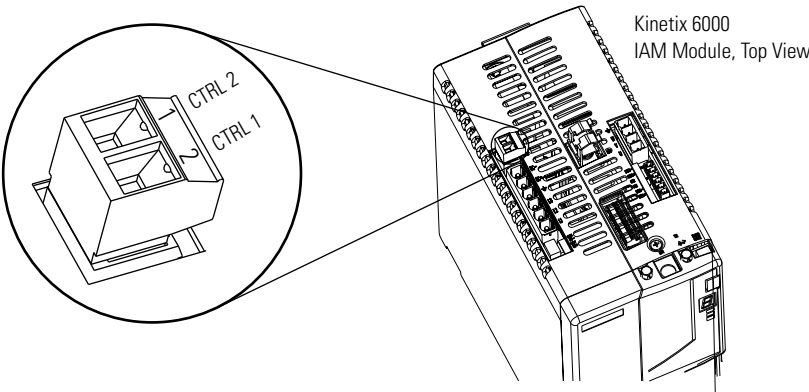
Wiring the IAM/AM Module Connectors

This section provides examples and wiring tables to assist you in making connections to the IAM and AM modules.

Wire the Control Power (CPD) Connector

This example applies to any IAM, leader IAM, or follower IAM module.

Figure 46 - IAM Module (CPD connector)



IMPORTANT The 2094-AL75S, 2094-BL75S, and 2094-XL75S-C2 LIM modules can supply input power for up to eight axes. The 2094-XL75S-C1 LIM module can supply up to sixteen axes.

IMPORTANT Control power isolation, via a step-down transformer, is required for all 460V applications. Source 2094-ACxx-Mxx-S (230V) IAM module control power from the three-phase input power (line-to-line). Supplying control power from any other source requires an isolation transformer. If used, do not ground either leg of the isolation transformer output.

The National Electrical Code and local electrical codes take precedence over the values and methods provided. Implementation of these codes is the responsibility of the machine builder.

Refer to Control Power on [page 72](#) for more information and IAM Module (without LIM module) on [page 204](#) for the interconnect drawing.

Table 51 - Control Power (CPD) Connector

CPL Connector (LIM module) or Other Single-phase Input				CPD Connector (IAM module)		Recommended Wire Size mm ² (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
2094-ALxxS, 2094-BLxxS, or 2094-XL75S-Cx LIM Module		2094-AL09 and 2094-BL02 LIM Module						
CPL Pin	Signal	CPL Pin	Signal	CPD Pin	Signal	2.5 (14)	10 (0.38)	0.5...0.6 (4.4...5.3)
1	CTRL 1	2	L1	1	CTRL 2			
2	CTRL 2	1	L2/N	2	CTRL 1			

Wire the Input Power (IPD) Connector

This example applies to any IAM module or common-bus leader IAM module.



ATTENTION: Make sure the input power connections are correct when wiring the IPD connector plug and that the plug is fully engaged in the module connector. Incorrect wiring/polarity or loose wiring can cause explosion or damage to equipment.

Figure 47 - IAM Module (IPD connector)

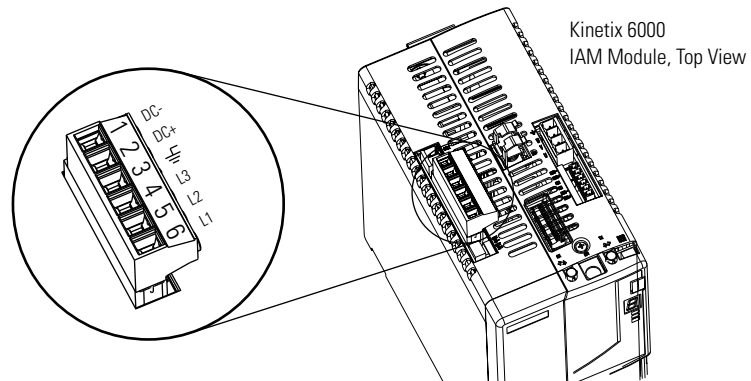


Table 52 - Input Power (IPD) Connections

OPL Connector (LIM module) or Other Three-phase Input				IPD Connector (IAM or leader IAM module)	
2094-AL09 LIM Module		2094-ALxxS, 2094-BLxxS, or 2094-XL75S-Cx LIM Modules			
OPL Pin	Signal	OPL Pin	Signal	IPD Pin	Signal
1	L1'	4	L1'	6	L1
2	L2'	3	L2'	5	L2
3	L3'	2	L3'	4	L3
4	$\perp$	1	$\perp$	3	$\perp$
N/A				2	DC+
				1	DC-

Table 53 - Termination Specifications

IAM Module Cat. No.	Input VAC	Recommended Wire Size mm ² (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
2094-AC05-Mxx-x 2094-AC09-M02-x	230V AC	2.5 (14)	10 (0.38)	0.5...0.6 (4.4...5.3)
2094-AC16-M03-x		10 (8)	16 (0.63)	2.4...3.0 (21.6...26.5)
2094-AC32-M05-x		25 (4)		
2094-BC01-Mxx-x 2094-BC02-M02-x	460V AC	4.0 (12)	10 (0.38)	1.2...1.5 (10.6...13.2)
2094-BC04-M03-x		10 (8)	16 (0.63)	2.4...3.0 (21.6...26.5)
2094-BC07-M05-x		25 (4)		

This example applies to a common-bus follower IAM module.



ATTENTION: Make sure the common-bus power connections are correct when wiring the IPD connector plug and that the plug is fully engaged in the module connector. Incorrect wiring/polarity or loose wiring can cause explosion or damage to equipment.

Figure 48 - IAM Module (IPD connector)

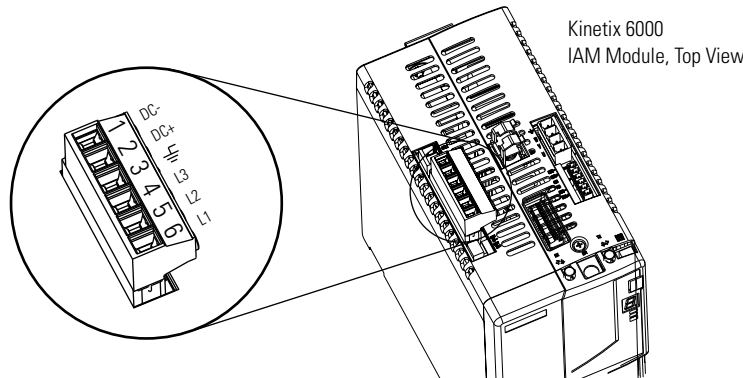


Table 54 - Input Power (IPD) Connections

IPD Connector (IAM or follower IAM module)	
IPD Pin	Signal
6	N.C.
5	N.C.
4	N.C.
3	$\perp$
2	DC+
1	DC-

IMPORTANT Do not connect three-phase input power to the common-bus follower IAM module.

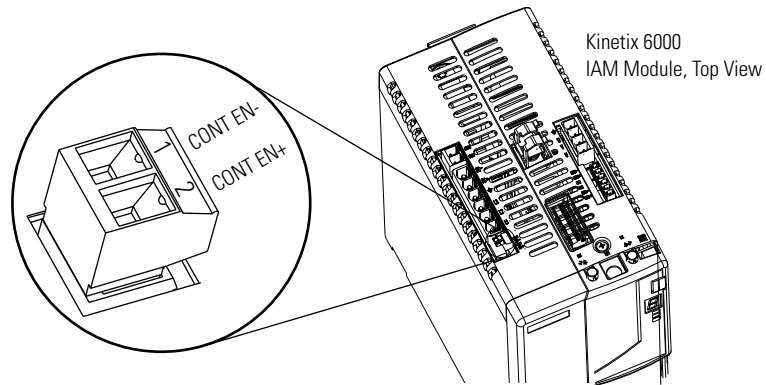
Table 55 - Termination Specifications

IAM Module Cat. No.	Input VAC	Recommended Wire Size mm ² (AWG)	Strip Length mm (in.)	Torque Value N•m (lbf•in)
2094-AC05-Mxx-x 2094-AC09-M02-x	230V AC	2.5 (14)	10 (0.38)	0.5...0.6 (4.4...5.3)
2094-AC16-M03-x		10 (8)	16 (0.63)	2.4...3.0 (21.6...26.5)
2094-AC32-M05-x		25 (4)		
2094-BC01-Mxx-x 2094-BC02-M02-x	460V AC	4.0 (12)	10 (0.38)	1.2...1.5 (10.6...13.2)
2094-BC04-M03-x		10 (8)	16 (0.63)	2.4...3.0 (21.6...26.5)
2094-BC07-M05-x		25 (4)		

Wire the Contactor Enable (CED) Connector

This example applies to any IAM, common-bus leader IAM, or common-bus follower IAM module.

Figure 49 - IAM Module (CED connector)



ATTENTION: Wiring the contactor enable relay is required. To avoid personal injury or damage to the drive, wire the contactor enable relay into your safety control string. Refer to Contactor Enable Relay on [page 66](#).

In common-bus configurations, the contactor enable (CED) connections for leader and follower drives must be wired in series to the safety control string.

For interconnect diagrams, refer to Interconnect Diagram Notes beginning on [page 200](#).

Table 56 - Contactor Enable (CED) Connector

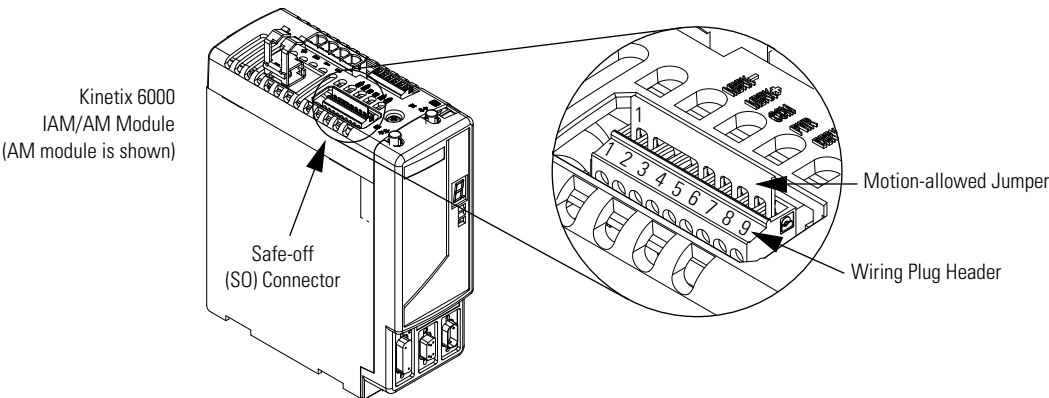
LIM Module I/O (IOL) Connector or Other Control String		CED Pin	Signal	Recommended Wire Size mm ² (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
2094-ALxxS, 2094-BLxxS, or 2094-XL75S-Cx LIM Modules	2094-AL09 and 2094-BL02 LIM Modules					
IO_COM1	IO_COM	1	CONT EN-	2.5 (14) ⁽¹⁾	10 (0.38)	0.5...0.6 (4.4...5.3)
COIL_E2	COIL_A2	2	CONT EN+			

⁽¹⁾ The actual gauge of the contactor enable wiring depends on the system configuration. Consult your machine builder, the NEC, and applicable local codes.

Wiring the Safe-off (SO) Connector

This example applies to any IAM or AM module equipped with the safe-off (SO) connector.

Figure 50 - IAM/AM Module (SO connector)



Each IAM and AM module ships with the (9-pin) wiring-plug header and motion-allowed jumper installed in the safe-off connector. With the motion-allowed jumper installed, the safe-off feature is not used.

Pinouts for the safe-off (SO) connector are shown on [page 56](#).

IMPORTANT Pins SO-8 and SO-9 (24V+) are used by only the motion-allowed jumper. When wiring to the wiring-plug header, the 24V supply must come from an external source.

Table 57 - Safe-off (SO) Connector

SO Pin	Signal	Recommended Wire Size mm ² (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
1	FDBK2+	0.75 (18) (stranded wire with ferrule)	7.0 (0.275)	0.235 (2.0)
2	FDBK2-			
3	FDBK1+			
4	FDBK1-			
5	SAFETY ENABLE2+	1.5 (16) (solid wire)		
6	SAFETY ENABLE-			
7	SAFETY ENABLE1+			
8	24V +			
9	24V_COM			

To wire the safe-off connector in single axis or multi-axis configurations, refer to the Kinetix Safe-off Feature Safety Reference Manual, publication [GMC-RM002](#).

Wire the Motor Power (MP) Connector

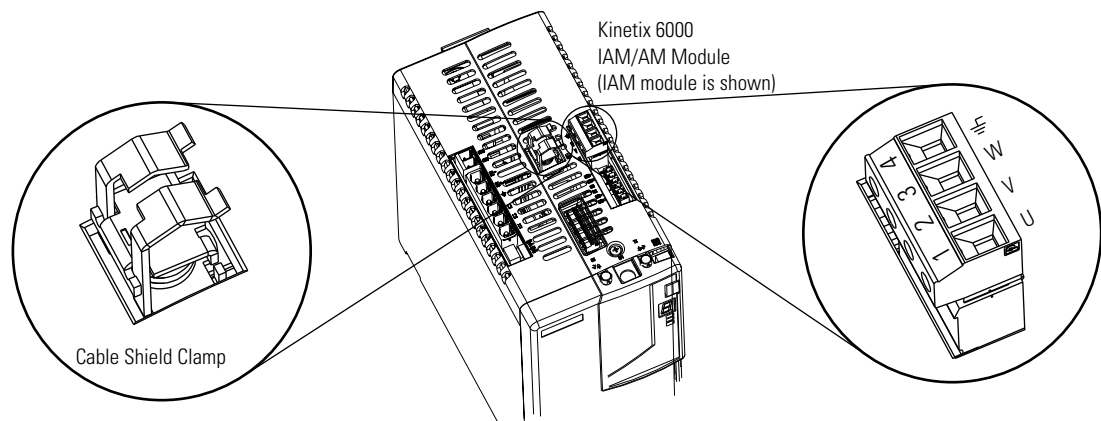
Connections to the motor power (MP) connector include rotary motors, linear motors, and motor driven actuators.



ATTENTION: Make sure the motor power connections are correct when wiring the MP connector plug and that the plug is fully engaged in the module connector. Incorrect wiring/polarity or loose wiring can cause explosion or damage to equipment.

This example applies to AM modules and the inverter section of IAM modules.

Figure 51 - IAM/AM Module (MP connector)



Cable Shield Terminations

Factory-supplied Bulletin 2090 motor power cables for motors and actuators are shielded, and the braided cable shield must terminate at the drive during installation. A small portion of the cable jacket must be removed to expose the shield braid. The exposed area must be clamped (with the clamp provided) on top of the IAM or AM modules and the power wires terminated in the motor power (MP) connector plug.



SHOCK HAZARD: To avoid hazard of electrical shock, make sure shielded power cables are grounded at a minimum of one point for safety.

IMPORTANT

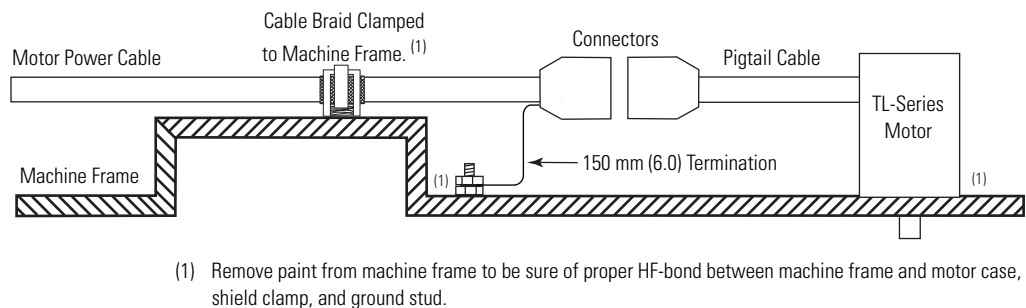
For TL-Series motors, also connect the 152 mm (6.0 in.) termination wire to the closest earth ground.

Refer to Pigtail Terminations on [page 100](#) for more information.

Pigtail Terminations

TL-Series motors have a short pigtail cable that connects to the motor, but is not shielded. The preferred method for grounding the TL-Series power cable on the motor side is to expose a section of the cable shield and clamp it directly to the machine frame. The motor power cable also has a 150 mm (6.0 in.) shield termination wire with a ring lug that connects to the closest earth ground. Use this method in addition to the cable clamp. The termination wire may be extended to the full length of the motor pigtail if necessary, but it is best to connect the supplied wire directly to ground without lengthening.

Figure 52 - Pigtail Terminations



MP-Series (Bulletin MPL) Motor Connectors

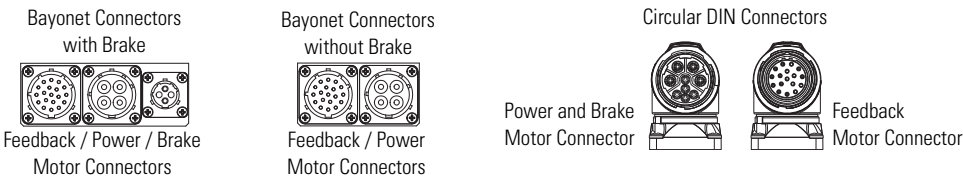
Bulletin MPL motors equipped with circular DIN connectors (specified by 4 or 7 in the catalog number) are not compatible with cables designed for motors equipped with bayonet connectors (specified by 2 in the catalog number). The motors with bayonet connectors are being discontinued.

Table 58 - MP-Series (Bulletin MPL) Motor Catalog Numbers

Motor Cat. No. /Circular DIN Connectors	Motor Cat. No. /Bayonet Connectors
MPL-A/B15xxx-xx4xAA MPL-A/B2xxx-xx4xAA	N/A
MPL-A/B3xxx-xx7xAA, MPL-A/B4xxx-xx7xAA, MPL-A/B45xxx-xx7xAA, MPL-A/B5xxx-xx7xAA	MPL-A/B3xxx-xx2xAA, MPL-A/B4xxx-xx2xAA, MPL-A/B45xxx-xx2xAA, MPL-A/B5xxx-xx2xAA
MPL-B6xxx-xx7xAA, MPL-B8xxx-xx7xAA, MPL-B9xxx-xx7xAA	MPL-B6xxx-xx2xAA, MPL-B8xxx-xx2xAA, MPL-B9xxx-xx2xAA

Bayonet connectors can be mounted facing the motor shaft or end plate and provide a separate connector for power, feedback, and brake connections. Circular DIN connectors rotate up to 180° and combine power and brake wires in the same connector, eliminating the brake connector.

Figure 53 - Bayonet and Circular DIN Motor Connectors



Motor Power Wiring Examples

The procedure for wiring motor power varies slightly, depending on the motor family. The cables compatible with your motor or actuator depend on the connectors installed on the motor or actuator. Refer to MP-Series (Bulletin MPL) Motor Connectors on [page 100](#) for more information on circular DIN and bayonet connectors.

Table 59 - Motor Power Cable Compatibility

Motor/Actuator	Connector Type	Motor/Actuator Cat. No.	Motor Power Cables (with brake wires)	Motor Power Cables (without brake wires)
MP-Series (Bulletin MPL)	Circular DIN	MPL-A/B15xxx-xx4xAA, MPL-A/B2xxx-xx4xAA	2090-XXNPMF-xxSxx (standard) or 2090-CPBM4DF-xxAFxx (continuous-flex)	2090-CPWM4DF-xxAFxx (continuous-flex)
		MPL-A/B3xxx-xx7xAA, MPL-A/B4xxx-xx7xAA, MPL-A/B45xxx-xx7xAA, MPL-A/B5xxx-xx7xAA, MPL-B6xxx-xx7xAA, MPL-B8xxx-xx7xAA, MPL-B9xxx-xx7xAA	2090-CPBM7DF-xxAAxx ⁽¹⁾ or 2090-XXNPMF-xxSxx (standard) or 2090-CPBM7DF-xxAFxx (continuous-flex)	2090-CPWM7DF-xxAAxx ⁽¹⁾ (standard) or 2090-CPWM7DF-xxAFxx (continuous-flex)
	Bayonet	MPL-A/B3xxx-xx2xAA, MPL-A/B4xxx-xx2xAA, MPL-A/B45xxx-xx2xAA, MPL-A/B5xxx-xx2xAA, MPL-B6xxx-xx2xAA, MPL-B8xxx-xx2xAA, MPL-B960B-xx2xAA, MPL-B960C-xx2xAA, MPL-B980B-xx2xAA, and MPL-B980C-xx2xAA	N/A	2090-XXxPMP-xxSxx ⁽²⁾
		MPL-B960D-xx2xAA, MPL-B980D-xx2xAA		2090-MCNPMP-6Sxx
		1326AB-Bxxxx-M2L/S2L		2090-XXxPMP-xxSxx ⁽²⁾
		F-xxxx		2090-XXNPHF-xxSxx
1326AB (M2L/S2L)				
F-Series				
1326AB (resolver)		1326AB-Bxxxx-21	1326-CPx1T-L-xxx (continuous-flex)	N/A
MP-Series (Bulletin MPS)	Circular DIN	MPS-A/Bxxxx	2090-XXNPMF-xxSxx (standard) or 2090-CPBM4DF-xxAFxx (continuous-flex)	2090-CPWM4DF-xxAFxx (continuous-flex)
MP-Series (Bulletin MPAS)		MPAS-A/Bxxxx		
MP-Series (Bulletin MPAR)		MPAR-A/B1xxx and MPAR-A/B2xxx		
MP-Series (Bulletin MPM)		MPM-A/Bxxxx	2090-CPBM7DF-xxAAxx ⁽¹⁾ or 2090-XXNPMF-xxSxx (standard) or 2090-CPBM7DF-xxAFxx (continuous-flex)	2090-CPWM7DF-xxAAxx ⁽¹⁾ (standard) or 2090-CPWM7DF-xxAFxx (continuous-flex)
MP-Series (Bulletin MPF)		MPF-A/Bxxxx		
RDD-Series		RDD-Bxxxx		
LDC-Series		LDC-Cxxxx		
MP-Series (Bulletin MPAl)		MPAl-A/Bxxxx		
MP-Series (Bulletin MPAR)		MPAR-A/B3xxx		
LDL-Series		LDL-xxxxxxx		
TL-Series (Bulletin TLY)	Circular Plastic	TLY-Axxxx-H	2090-CPBM6DF-16AAxx (standard)	2090-CPWM6DF-16AAxx (standard)

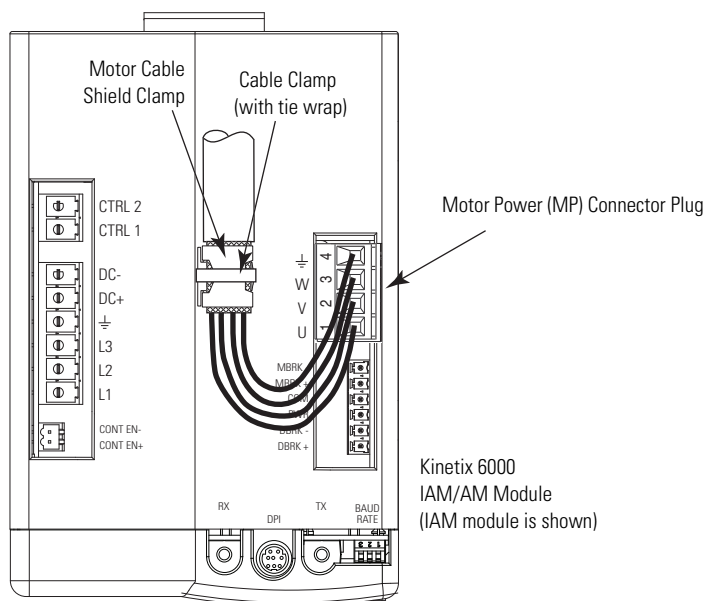
(1) For motors with circular DIN connectors, either 2090-CPxM7DF-xxAxxx, 2090-CPxM4DF-xxAFxx, or 2090-XXNPMF-xxSxx cables are compatible. However, you must remove the motor-side o-ring when using 2090-CPxM7DF-xxAxxx cables.

(2) For Bulletin MPL or 1326AB motors equipped with bayonet connectors. These cables are available as standard (catalog number 2090-XXNPMP-xxSxx) and continuous-flex (catalog number 2090-XXTPMP-xxSxx).

These cables contain only the three-phase power wires. The motors/actuators either have no brake or a separate connector for brake connections. Thermal switch wires are included in the feedback cable.

Refer to Axis Module/Rotary Motor Wiring Examples beginning on [page 212](#) for interconnect diagrams.

Figure 54 - Motor Power Terminations (cables without brake wires)



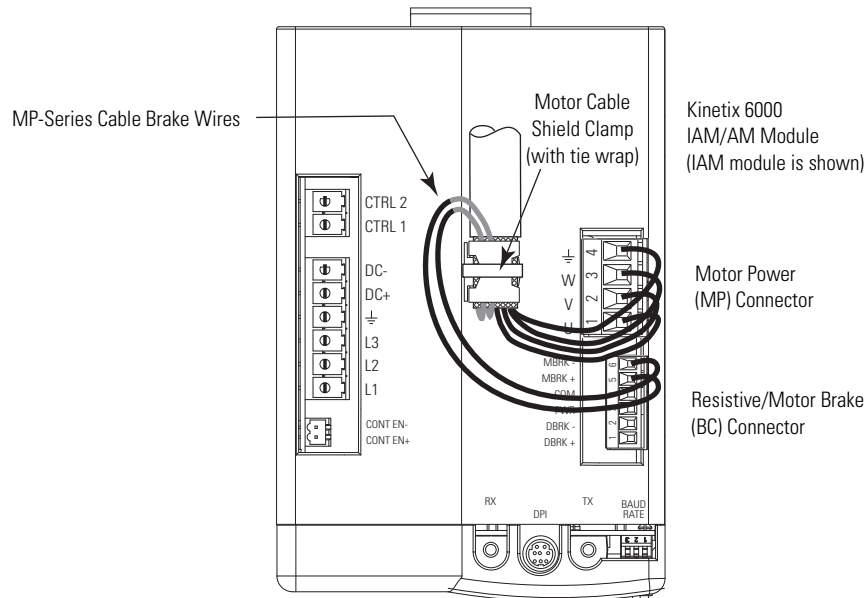
The cable shield clamp shown above is mounted to an IAM module. Cables attach to the clamp on each AM module in the same way.

IMPORTANT We recommend securing the cable shield in the clamp with a tie wrap to improve stress relief.

These cables contain three-phase power wires and brake wires. The brake wires have a shield braid (shown below as gray) that folds back under the cable clamp before the conductors are attached to the motor brake (BC) connector. Thermal switch wires are included in the feedback cable.

Refer to Axis Module/Rotary Motor Wiring Examples beginning on [page 212](#) for interconnect diagrams.

Figure 55 - Motor Power Terminations (cables with brake wires)



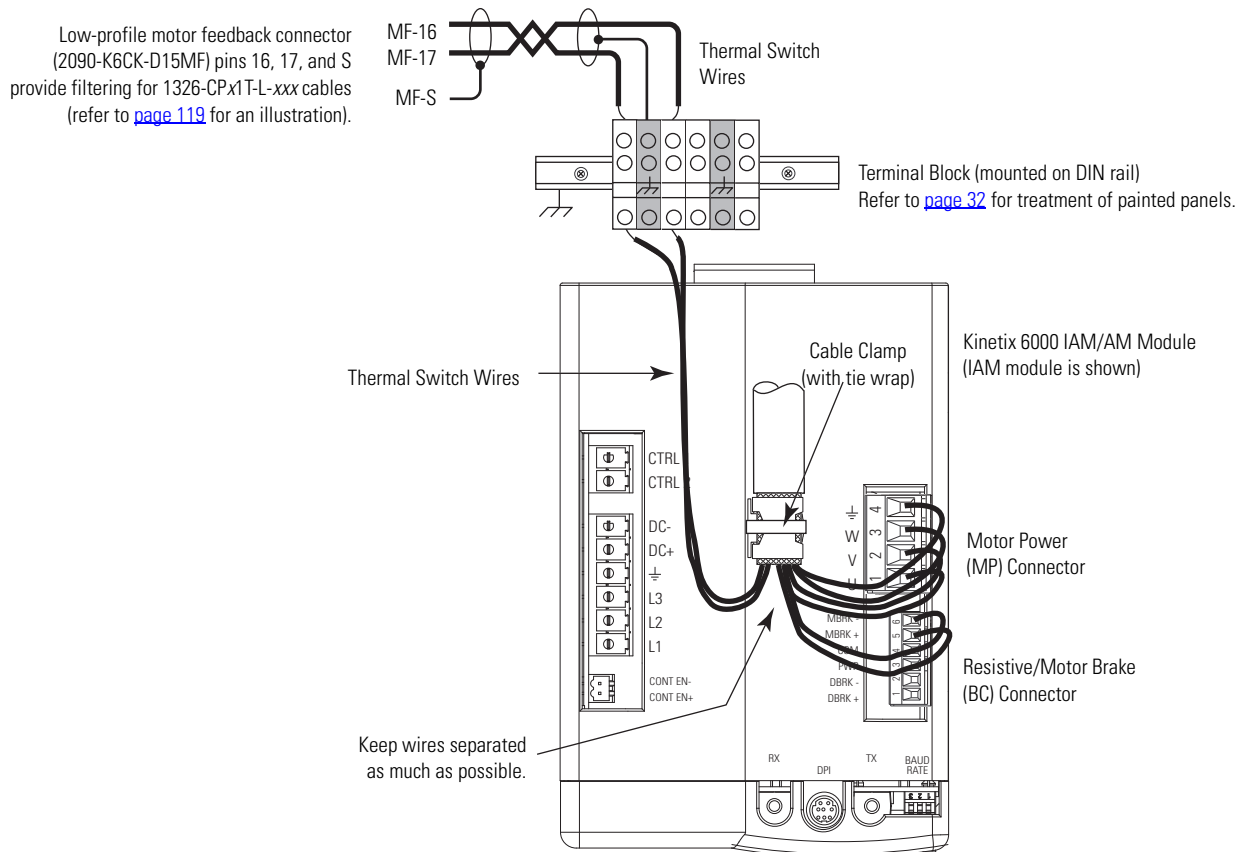
The cable shield clamp shown above is mounted to an IAM module. Cables attach to the clamp on each AM module in the same way.

IMPORTANT We recommend securing the cable shield in the clamp with a tie wrap to improve stress relief.

The 1326AB (resolver) power cables (catalog number 1326-CP_x1T-L-*xxx*) contain the three-phase wires, brake wires, and thermal switch wires. To improve the EMC performance of your system, route the wires as shown.

Refer to Axis Module/Rotary Motor Wiring Examples beginning on [page 212](#) for interconnect diagrams.

Figure 56 - Motor Power Terminations (1326-CP_x1T-L-*xxx* cable)

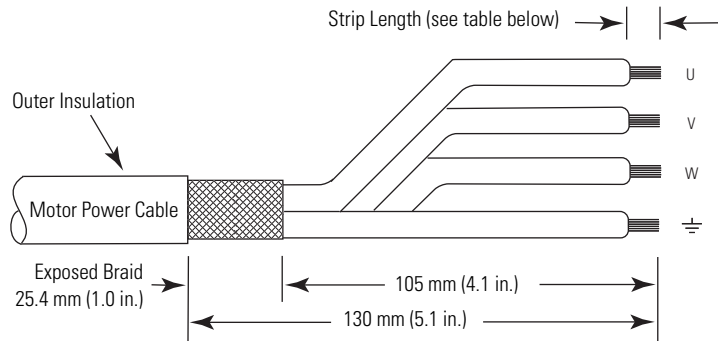


The cable shield clamp shown above is mounted to an IAM module. Cables attach to the clamp on each AM module in the same way.

IMPORTANT We recommend securing the cable shield in the clamp with a tie wrap to improve stress relief.

Cable shield and lead preparation is provided with most Allen-Bradley cable assemblies. Follow these guidelines if your motor power cable shield and wires require preparation.

Figure 57 - Cable Shield and Lead Preparation



Refer to Axis Module/Rotary Motor Wiring Examples beginning on [page 212](#) for interconnect diagrams.

Table 60 - Motor Power (MP) Connector

Servo Motor		MP Connector (IAM/AM module)	
1326AB (resolver)	All Other Motors	MP Pin	Signal
1 / Black	U / Brown	1	U
2 / Black	V / Black	2	V
3 / Black	W / Blue	3	W
Green/Yellow	⏏ Green/Yellow	4	⏏

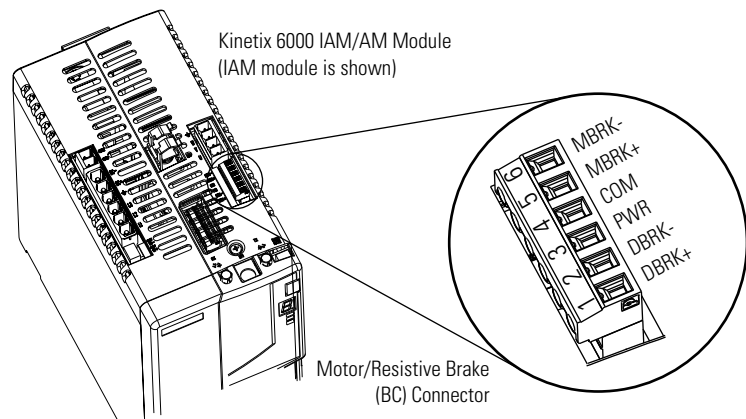
Table 61 - Termination Specifications

IAM/AM Module Cat. No.	Recommended Wire Size mm ² (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
2094-AC05-Mxx-x, 2094-AC09-M02-x, 2094-BC01-Mxx-x 2094-BC02-M02-x 2094-AMP5-x, 2094-AM01-x, 2094-AM02-x, 2094-BMP5-x, 2094-BM01-x, and 2094-BM02-x	6 (10) max	10 (0.38)	0.5...0.6 (4.4...5.3)
2094-AC16-M03-x 2094-AC32-M05-x 2094-AM03-x, 2094-AM05-x			1.2...1.5 (10.6...13.2)
2094-BC04-M03-x 2094-BC07-M05-x 2094-BM03-x, 2094-BM05-x	25 (4) max	16 (0.63)	2.4...3.0 (21.6...26.5)

Wire the Motor/Resistive Brake (BC) Connector

This example applies to AM modules and the inverter section of IAM modules.

Figure 58 - IAM/AM Module (BC connector)



24V DC Brake Input Power Connections

IMPORTANT If your system includes a LIM module, you can source the 24V DC from the LIM module (P1L or PSL connector).

Table 62 - Motor/Resistive Brake (BC) Connector

2094-ALxxS, 2094-BLxxS, 2094-XL75S-Cx LIM Modules		2094-AL09 and 2094-BL02 LIM Modules		BC Connector (IAM/AM modules)	
P1L Pin	Signal	PSL Pin	Signal	BC Pin	Signal
1	IO_PWR2	1	MBRK PWR	3	PWR
2	IO_COM2	2	MBRK COM	4	COM

RBM Module Connections

Table 63 - Motor/Resistive Brake (BC) Connector

RBM Module I/O Connections		BC Connector (IAM/AM modules)	
TB3 Pin	Signal	MP Pin	Signal ⁽¹⁾
6	COIL_A1	1	DBRK+
7	COIL_A2	2	DBRK-

(1) Firmware revision 1.071 or later, is required to use the DBRK outputs on the Kinetix 6000 IAM/AM module.

Motor Brake Connections

The procedure for wiring your motor brake varies slightly, depending on the motor family. The cables compatible with your motor or actuator depend on the connectors installed on the motor or actuator. Refer to MP-Series (Bulletin MPL) Motor Connectors on [page 100](#) for more information on circular DIN and bayonet connectors.

Table 64 - Motor Brake Cable Compatibility

Motor Series	Connector Type	Brake Wires	Cable Cat. No.
MPL-A/B15xxx-xx4xAA, MPL-A/B2xxx-xx4xAA	Circular DIN	The motor/actuator does not have a brake connector. Brake wires are included in the power cable.	2090-XXNPMF-xxSxx ⁽¹⁾ (standard) 2090-CPBM4DF-xxAFxx (continuous-flex)
MPL-A/B3xxx-xx7xAA, MPL-A/B4xxx-xx7xAA, MPL-A/B45xxx-xx7xAA, MPL-A/B5xxx-xx7xAA, MPL-B6xxx-xx7xAA, MPL-B8xxx-xx7xAA, MPL-B9xxx-xx7xAA			2090-CPBM7DF-xxAAxx or ⁽¹⁾ 2090-XXNPMF-xxSxx (standard) 2090-CPBM7DF-xxAFxx (continuous-flex)
MPL-A/B3xxx-xx2xAA, MPL-A/B4xxx-xx2xAA, MPL-A/B45xxx-xx2xAA, MPL-A/B5xxx-xx2xAA, MPL-B6xxx-xx2xAA, MPL-B8xxx-xx2xAA, MPL-B9xxx-xx2xAA	Bayonet	The motor has a brake connector. Brake wires are in the brake cable.	2090-UXxBMP-18Sxx brake cable ⁽²⁾
1326AB (M2L/S2L)			Straight brake connector kit 9101-0330
F-Series			
MPS-A/Bxxx, MPAS-A/Bxxx, MPMA-A/Bxxx, MPAR-A/B1xxx, MPAR-A/B2xxx	Circular DIN	The motor/actuator does not have a brake connector. Brake wires are included in the power cable.	2090-XXNPMF-xxSxx ⁽¹⁾ (standard) 2090-CPBM4DF-xxAFxx (continuous-flex)
MPM-A/Bxxx, MPF-A/Bxxx, RDD-Series, LDC-Series, LDL-Series, MPAR-A/B3xxx, MPAL-A/Bxxx			2090-CPBM7DF-xxAAxx or ⁽¹⁾ 2090-XXNPMF-xxSxx (standard) 2090-CPBM7DF-xxAFxx (continuous-flex)
TLY-Axxxx-H	Circular Plastic		2090-CPBM6DF-16AAxx power cable
1326AB (resolver)	Bayonet		1326-CPx1T-L-xxx power cable

(1) For motors with circular DIN connectors, either 2090-CPBM7DF-xxAxxx, 2090-CPBM4DF-xxAFxx, or 2090-XXNPMF-xxSxx cables are compatible. However, you must remove the motor-side o-ring when using 2090-CPBM7DF-xxAxxx cables.

(2) For Bulletin MPL and 1326AB motors equipped with bayonet connectors. These cables are available as standard (catalog number 2090-UXNBMP-18Sxx) and continuous-flex (catalog number 2090-UXTBMP-18Sxx).

IMPORTANT Use surge suppression when controlling a brake coil. Refer to Controlling a Brake Example on [page 224](#).

Figure 59 - Brake Cable Preparation

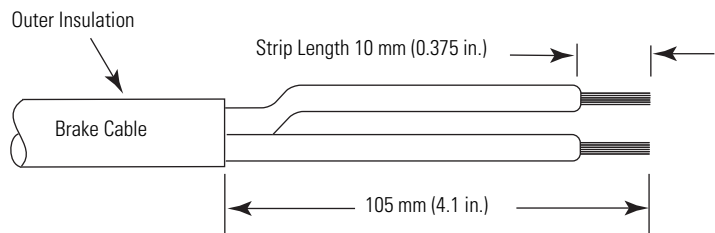


Table 65 - Motor/Resistive Brake (BC) Connector

Motor Brake Wires				BC Connector (IAM/AM module)	
2090-UXxBMP-18Sxx Brake Cable	2090-XXNPMF-xxSxx 2090-CPBMxDF-xxAFxx Power Cable	2090-CPBM6DF-16AAxx Power Cable	1326-CPx1T-L-xxx Power Cable	BC Pin	Signal
A / BR+	F/+ / BR+/MBRK+	7 / MBRK+	6 / B1	5	MBRK+
C / BR-	G/- / BR-/MBRK-	9 / MBRK-	4 / B2	6	MBRK-

Table 66 - Termination Specifications

BC Connector (IAM/AM module)		Recommended Wire Size mm ² (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
BC Pin	Signal			
BC-6 BC-5 BC-4 BC-3 BC-2 BC-1	MBRK- MBRK+ COM PWR DBRK- DBRK+	0.75 (18)	10 (0.38)	0.22...0.25 (1.9...2.2)

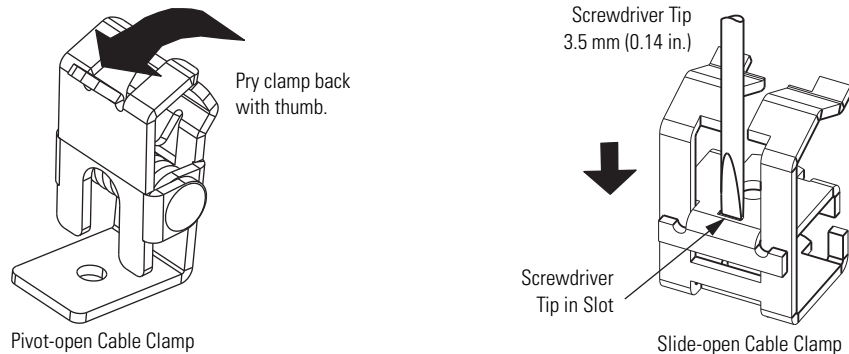
Apply the Motor Cable Shield Clamp

This procedure assumes you have completed wiring your motor power (MP) connector and are ready to apply the cable shield clamp.

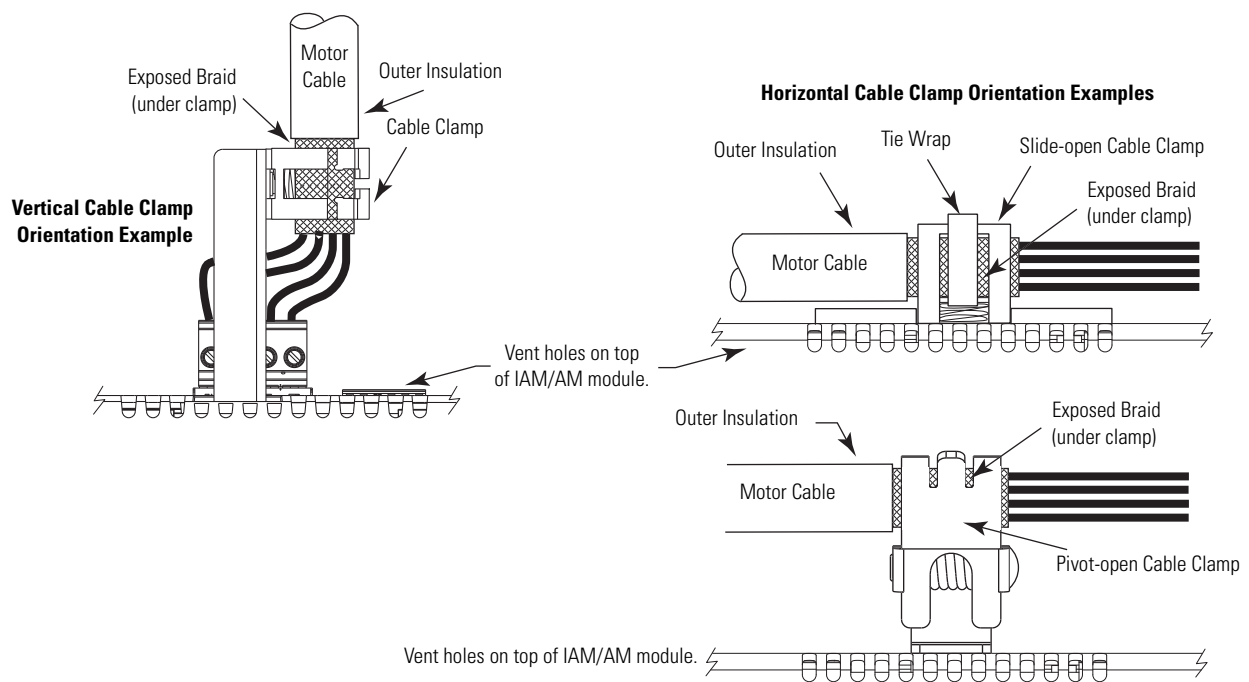
TIP Your drive may be equipped with either the pivot-open or slide-open cable clamp.

Follow these steps to apply the motor cable shield clamp.

1. Depress the spring loaded clamp.



2. Position the exposed portion of the cable braid directly in line with the clamp.
3. Release the spring, making sure the cable and cable braid are held secure by the clamp.
4. Attach tie wrap (slide-open clamp only) around cable and clamp for additional strain relief.



5. Repeat steps [1...4](#) for each IAM and AM module.

Feedback and I/O Cable Connections

Factory made cables with premolded connectors are designed to minimize EMI and are recommended over hand-built cables to improve system performance. However, other options are available for building your own feedback and I/O cables.

Table 67 - Options for Connecting Motor Feedback and I/O

Connection Option	Connector Kit Cat. No.	Cable	Using this Type of Cable
Premolded connectors	N/A	Motor feedback	Refer to Table 68 and Table 69 for the flying-lead cable available for your motor.
Low-profile connector kit	2090-K6CK-D15M	Motor feedback	
	2090-K6CK-D26M	I/O interface	User-supplied flying-lead cable.
	2090-K6CK-D15F	Auxiliary feedback	User-supplied flying-lead cable.
	2090-K6CK-D15MF	Motor feedback	1326-CCUT-L-xxx flying-lead feedback cable.
Low-profile feedback module	2090-K6CK-KENDAT		Refer to Table 68 and Table 69 for the flying-lead cable available for your motor.
Panel-mounted breakout board kits	2090-UXBK-D15xx ⁽¹⁾		

(1) Not compatible with 1326-CCUT-L-xxx cable.

The procedure for wiring your motor feedback varies slightly, depending on the motor family. The cables compatible with your motor or actuator depend on the connectors installed on the motor or actuator. Refer to MP-Series (Bulletin MPL) Motor Connectors on [page 100](#) for more information on circular DIN and bayonet connectors.

Table 68 - Motor Feedback Cable Compatibility - Bayonet Connectors

Motor/Actuator	Connector Type	Feedback Type	Feedback Cable		Pinout
			Premolded	Flying-lead	
MPL-A/Bxxx-S/Mx2xAA	Bayonet	High-resolution encoder	2090-UXNFBMP-Sxx	2090-XXxFMP-Sxx ⁽¹⁾	page 112
MPL-A3xxx-Hx2xAA MPL-A4xxx-Hx2xAA MPL-A45xxx-Hx2xAA		Incremental encoder			
MPL-B3xxx-Rx2xAA MPL-B4xxx-Rx2xAA MPL-B45xxx-Rx2xAA		Motor resolver	N/A	2090-CDNFDMP-Sxx	
1326AB-Bxxx-M2L/S2L		High-resolution encoder	2090-UXNFBMP-Sxx	2090-XXxFMP-Sxx ⁽¹⁾	page 114
1326AB-Bxxx-21		Motor resolver	N/A	1326-CCUT-L-xxx	
F-Series		Incremental encoder	2090-UXNFBHF-Sxx	2090-XXNFHF-Sxx	

(1) For Bulletin MPL and 1326AB (M2L/S2L) motors equipped with bayonet connectors. These cables are available as standard (catalog number 2090-XXNFBMP-Sxx) and continuous-flex (catalog number 2090-XXTFMP-Sxx).

Refer to MP-Series (Bulletin MPL) Motor Connectors on [page 100](#) for more information on circular DIN and bayonet connectors.

Table 69 - Motor Feedback Cable Compatibility - Circular DIN/Plastic Connectors

Motor/Actuator	Connector Type	Feedback Type	Feedback Cable		Pinout	
			Premolded	Flying-lead		
MPL-A/B15xxx-V/Ex4xAA MPL-A/B2xxx-V/Ex4xAA	Circular DIN	High-resolution encoder	N/A	2090-XXNFMF-Sxx ⁽¹⁾ (standard) 2090-CFBM4DF-CDAFxx ⁽¹⁾ (continuous-flex)	page 136	
MPL-A/B15xxx-Hx4xAA MPL-A/B2xxx-Hx4xAA		Incremental encoder				
MPL-A/B3xxx-S/Mx7xAA, MPL-A/B4xxx-S/Mx7xAA, MPL-A/B45xxx-S/Mx7xAA, MPL-A/B5xxx-S/Mx7xAA, MPL-B6xxx-S/Mx7xAA, MPL-B8xxx-xx7xAA MPL-B9xxx-S/Mx7xAA		High-resolution encoder		2090-XXNFMF-Sxx ⁽¹⁾ (standard) 2090-CFBM7DF-CDAFxx ⁽¹⁾ (continuous-flex)		
MPL-A3xxx-Hx7xAA MPL-A4xxx-Hx7xAA MPL-A45xxx-Hx7xAA		Incremental encoder				
MPL-B3xxx-Rx4xAA MPL-B4xxx-Rx4xAA MPL-B45xxx-Rx4xAA		Motor resolver		2090-CFBM4DF-CEAAxx	page 112	
MPM-A/Bxxxx-2		High-resolution encoder			2090-XXNFMF-Sxx ⁽¹⁾ (standard) 2090-CFBM4DF-CDAFxx ⁽¹⁾ (continuous-flex)	page 136
MPS-A/Bxxx-S/M						
MPAS-A/Bxxxx-V/A						
MPAR-A/B1xxx-V and MPAR-A/B2xxx-V						
MPF-A/Bxxx-S/M						
MPM-A/Bxxxx-S/M						
MPAR-A/B3xxx-M						
MPAI-A/BxxxxM3						
RDB-Bxxx-7/3						
LDC-Cxxx or LDL-xxxx						
TLY-Axxx-H	Circular Plastic	Incremental encoder	2090-CFBM6DD-CCAAxx	2090-CFBM6DF-CBAAxx		

(1) For motors with circular DIN connectors, either 2090-CFBM7DF-CDAFxx, 2090-CFBM4DF-CDAFxx, or 2090-XXNPMF-Sxx cables are compatible. However, you must remove the motor-side o-ring when using 2090-CFBM7DF-CDAFxx cables.

Flying-lead Feedback Cable Pin-outs

Table 70 - 2090-XXxFMP-Sxx Feedback Cable ⁽¹⁾

Bayonet Connector Pin	High-resolution Feedback		Incremental Feedback	Drive MF Connector Pin
Rotary Motors	MPL-B3xxx...MPL-B9xxx-M/S MPL-A5xxx-M/S 1326AB-Bxxx-M2L/S2L	MPL-A3xxx-M/S MPL-A4xxx-M/S MPL-A45xxx-M/S	MPL-A3xxx-H MPL-A4xxx-H MPL-A45xxx-H	
A	Sin+	Sin+	AM+	1
B	Sin-	Sin-	AM-	2
C	Cos+	Cos+	BM+	3
D	Cos-	Cos-	BM-	4
E	Data+	Data+	IM+	5
F	Data-	Data-	IM-	10
K	Reserved	EPWR_5V	EPWR_5V	14
L	Reserved	ECOM	ECOM	6
N	EPWR_9V	Reserved	Reserved	7
P	ECOM	Reserved	Reserved	6
R	TS+	TS+	TS+	11
S	TS-	TS-	TS-	—
T	Reserved	Reserved	S1	12
U	Reserved	Reserved	S2	13
V	Reserved	Reserved	S3	8

(1) These cables are available as standard (catalog number 2090-XXNFMP-Sxx) and continuous-flex (catalog number 2090-XXTFMP-Sxx).

Table 71 - 2090-CFBM4DF-CEAAxx Feedback Cable

Motor DIN Connector Pin	Resolver Feedback MPL-Bxxxx-R MPM-xxxxxx-2	Drive MF Connector Pin
1	S2	1
2	S4	2
3	S1	3
4	S3	4
5	R1	5
6	R2	10
11	EPWR_9V	7
12	ECOM	6
13	TS+	11
14	TS-	6

Table 72 - 2090-CDNFDMP-Sxx Feedback Cable

Motor Bayonet Connector Pin	Resolver Feedback MPL-Bxxxx-R	Drive MF Connector Pin
A	S2	1
B	S4	2
C	S1	3
D	S3	4
G	R1	5
H	R2	10
N	EPWR_9V	7
P	ECOM	6
R	TS+	11
S	TS-	6

Table 73 - 2090-XXNFMF-Sxx or 2090-CFBMxDF-CDAFxx Feedback Cables

Circular DIN Connector Pin	High-resolution Feedback		Incremental Feedback	Drive MF Connector Pin
Rotary Motors	MPL-B15xxx...MPL-B2xxx-V/E MPF/MPS-Bxxx-M/S MPF-A5xxx-M/S	MPL-A15xxx...MPL-A2xxx-V/E MPF/MPS-A3xx-M/S MPF/MPS-A4xx-M/S MPF/MPS-A45xx-M/S MPS-A5xxx-M/S RDB-Bxxxxx-3/7 MPL-A3xxx-M/S MPL-A4xxx-M/S MPL-A45xxx-M/S	MPL-A15xxx-H MPL-A2xxx-H MPL-B15xxx-H MPL-B2xxx-H MPL-A3xxx-H MPL-A4xxx-H MPL-A45xxx-H	
	MPL-B3xxx...MPL-B9xxx-M/S MPL-A5xxx-M/S 1326AB-Bxxx-M2L/S2L			
Linear Motors	N/A	LDC-Cxxxx and LDL-xxxx	LDC-Cxxxx and LDL-xxxx	
Linear Actuators	MPAS-Bxxxxx-VxxSxA MPAR-Bxxxx, MPAL-Bxxxx	MPAS-Axxxxx-VxxSxA MPAR-Axxxx, MPAL-Axxxx	MPAS-A/Bxxxxx-ALMx2C	
1	Sin+	Sin+	AM+	1
2	Sin-	Sin-	AM-	2
3	Cos+	Cos+	BM+	3
4	Cos-	Cos-	BM-	4
5	Data+	Data+	IM+	5
6	Data-	Data-	IM-	10
9	Reserved	EPWR_5V	EPWR_5V	14
10	Reserved	ECOM	ECOM	6
11	EPWR_9V	Reserved	Reserved	7
12	ECOM	Reserved	Reserved	6
13	TS+	TS+	TS+	11
14	TS-	TS-	TS-	–
15	Reserved	Reserved	S1	12
16	Reserved	Reserved	S2	13
17	Reserved	Reserved	S3	8

Table 74 - 2090-CFBM6DF-CBAAxx Feedback Cable

Rotary Motor Connector Pin	Incremental Feedback	Drive MF Connector Pin
	TLY-Axxxx-H	
9	AM+	1
10	AM-	2
11	BM+	3
12	BM-	4
13	IM+	5
14	IM-	10
15	S1	12
17	S2	13
19	S3	8
22	EPWR_5V	14
23	ECOM	6
24	Shield	Connector housing

Table 75 - 2090-XXNFHF-Sxx Feedback Cable

Rotary Motor Connector Pin	Incremental Feedback	Drive MF Connector Pin
	F-Series Motors	
A	AM+	1
B	AM-	2
C	BM+	3
D	BM-	4
E	IM+	5
F	IM-	10
G	Reserved	—
H	Reserved	—
J	EPWR_5VM	14
K	EPWR_5VM	14
L	ECOMM	6
M	ECOMM	6
N	S2	13
P	S3	8
R	TS+	11
S	TS-	6
T	S1	12

Table 76 - 1326-CCUT-L-xxx Feedback Cable

Rotary Motor Connector Pin	Resolver Feedback 1326AB-Bxxxx-21	Drive MF Connector Pin ⁽¹⁾
A	R1	5
B	R2	10
C	—	—
D	S1	3
E	S3	4
F	—	—
G	S2	1
H	S4	2

Table 77 - 1326-CPx1T-L-xxx Power Cable

Rotary Motor Connector Pin	Thermal Switch Connections 1326AB-Bxxxx-21	Drive MF Connector Pin ⁽²⁾
5	TS+	16
9	TS-	17
—	Shield	S

- (1) For termination of individual drain wires, use Low Profile connector kit (catalog number 2090-K6CK-D15MF) and reference figure on [page 119](#).
- (2) Thermal switch wires (5 and 9) are in the motor power cable (catalog number 1326-CPx1T-L-xxx). Use Low Profile connector kit (catalog number 2090-K6CK-D15MF) and reference figure on [page 119](#).

Wiring the Feedback and I/O Connectors

These procedures assume you have mounted your Kinetix 6000 system, completed all power wiring, and are ready to connect your feedback and I/O cables.

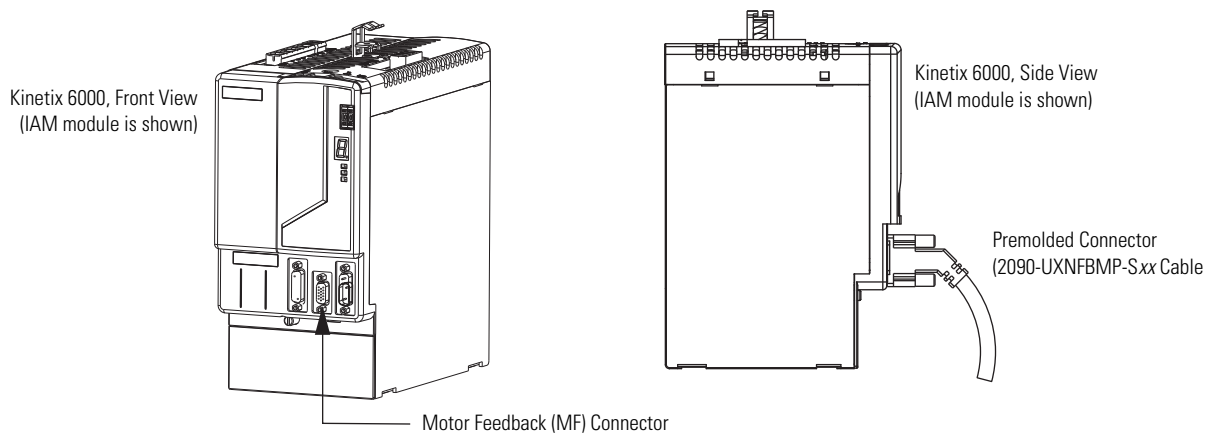
For This Connection	Go to
Premolded cable	Connect Premolded Motor Feedback Cables on page 115 .
Panel-mounted breakout board	Connect Panel-mounted Breakout Board Kits on page 116 .
Low-profile connector	Wire Low-profile Connector Kits on page 117 .

Connect Premolded Motor Feedback Cables

Motor feedback cables with premolded connectors plug directly into 15-pin motor feedback (MF) connectors on either the IAM or AM modules (no wiring is necessary).

IMPORTANT When using Bulletin 2090 cables with premolded connectors, tighten the mounting screws (finger tight) to improve system performance.

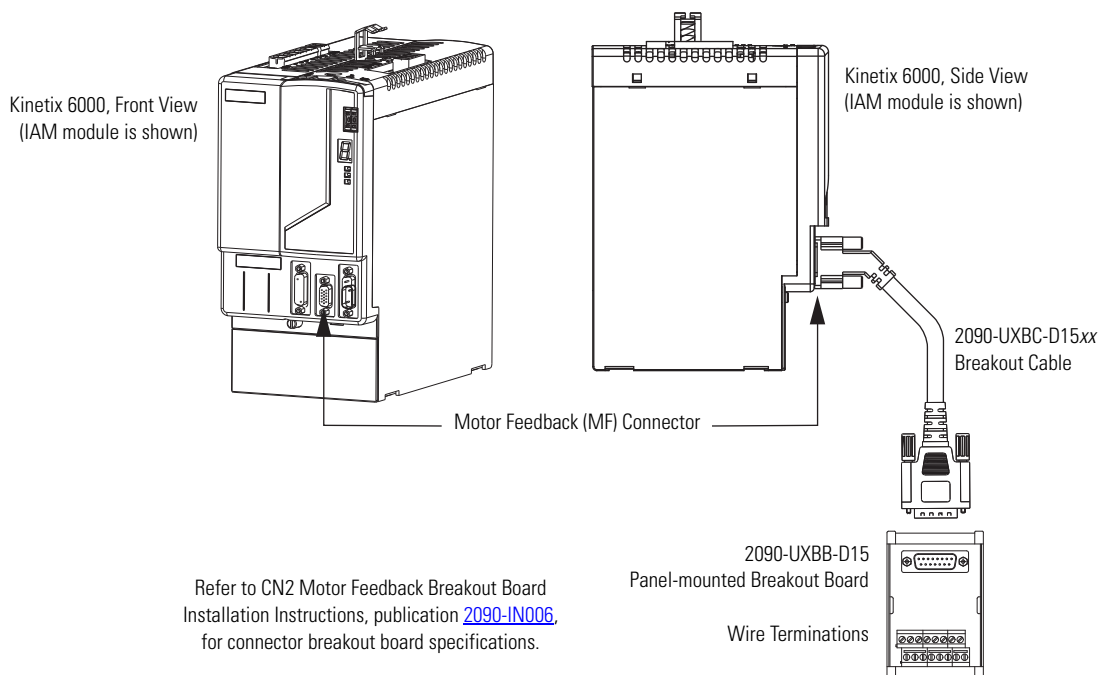
Figure 60 - IAM/AM Module (MF connector)



Connect Panel-mounted Breakout Board Kits

The 2090-UXBK-D15xx panel-mounted breakout board kit includes a DIN-rail breakout board and cable. The cable connects between the breakout board and the motor feedback (MF) connector. Wires from your flying-lead motor feedback cable connect to the terminals.

Figure 61 - IAM/AM Module (MF connector)



IMPORTANT The panel-mounted breakout board kit (2090-UXBK-D15xx) is not compatible with 1326-CCUT-L-xxx cable.

Wire Low-profile Connector Kits

The 2090-K6CK-xxxx low-profile connector kits are suitable for terminating flying-lead motor feedback, auxiliary feedback, and I/O connections. They also apply to I/O connections on the 2094-AL09 and 2094-BL02 LIM modules.

Table 78 - Low-profile Connector Kits

Connector Kit Cat. No.	Description	Cable Compatibility
2090-K6CK-KENDAT	Low-profile feedback module for EnDat to Hiperface conversion (15-pin, male, D-sub). Use with any Kinetix 6000 IAM/AM module and Bulletin RDB direct-drive motor with EnDat high-resolution feedback.	2090-XXxFMP-Sxx, 2090-XXNFMF-Sxx, 2090-XXNFHF-Sxx, 2090-CFBMxDF-CxAxxx
2090-K6CK-D15M	Low-profile connector kit for motor feedback (15-pin, male, D-sub). Use with any Kinetix 6000 IAM/AM module and compatible motors with incremental or high-resolution feedback.	2090-XXxFMP-Sxx, 2090-XXNFMF-Sxx, 2090-XXNFHF-Sxx, 2090-CFBMxDF-CxAxxx
	Low-profile connector kit for motor feedback (15-pin, male, D-sub). Use with Kinetix 6000 IAM/AM module and MPL-Bxxxx-R (resolver feedback) motors.	2090-CDNFDMP-Sxx 2090-CFBM4DF-CEAxx
2090-K6CK-D15MF	Low-profile connector kit for motor feedback (15-pin, male, D-sub) with filter. Use with Kinetix 6000 IAM/AM module and 1326ABxxxx-21 (resolver feedback) motors.	1326-CCUT-L-xxx
2090-K6CK-D15F	Low-profile connector kit for auxiliary feedback (15-pin, female, D-sub). Use with any Kinetix 6000 IAM/AM module for auxiliary feedback applications.	Customer Supplied
2090-K6CK-D26M	Low-profile connector kit for I/O (26-pin, male, D-sub). Use with any Kinetix 6000 IAM/AM module or 2094-AL09 and 2094-BL02 LIM module for making I/O connections.	Customer supplied

Figure 62 - IAM/AM Module (IOD/MF/AF connectors)

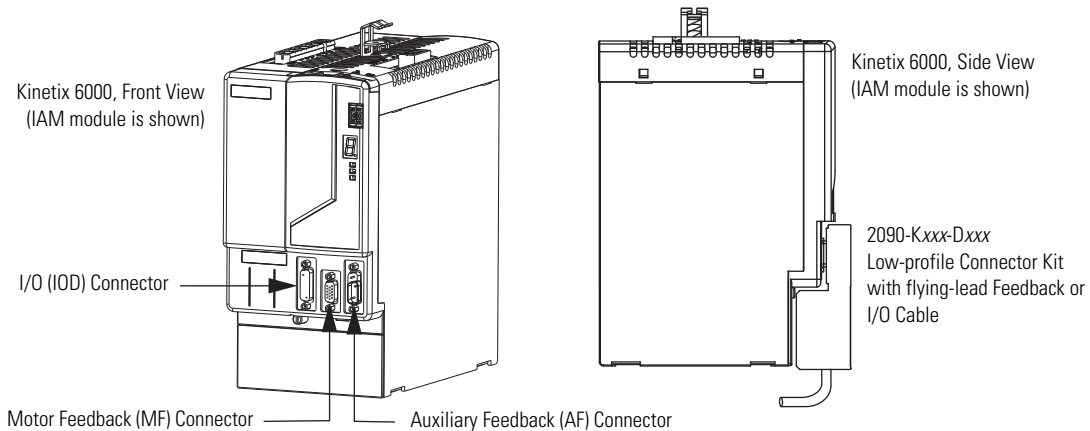


**Figure 63 - Wiring (15-pin) Flying-lead Feedback Cable Connections
2090-K6CK-D15M and 2090-K6CK-D15F Connector Kit**

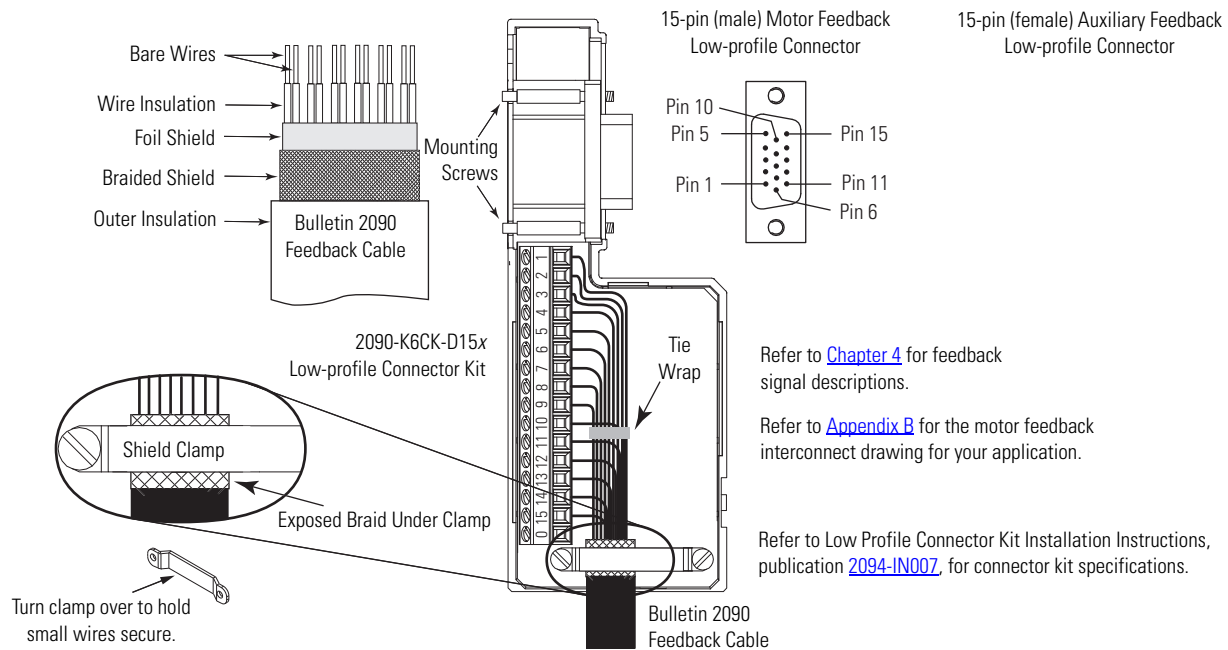


**Figure 64 - Wiring (15-pin) Flying-lead Feedback Cable Connections
2090-K6CK-KENDAT Feedback Module**

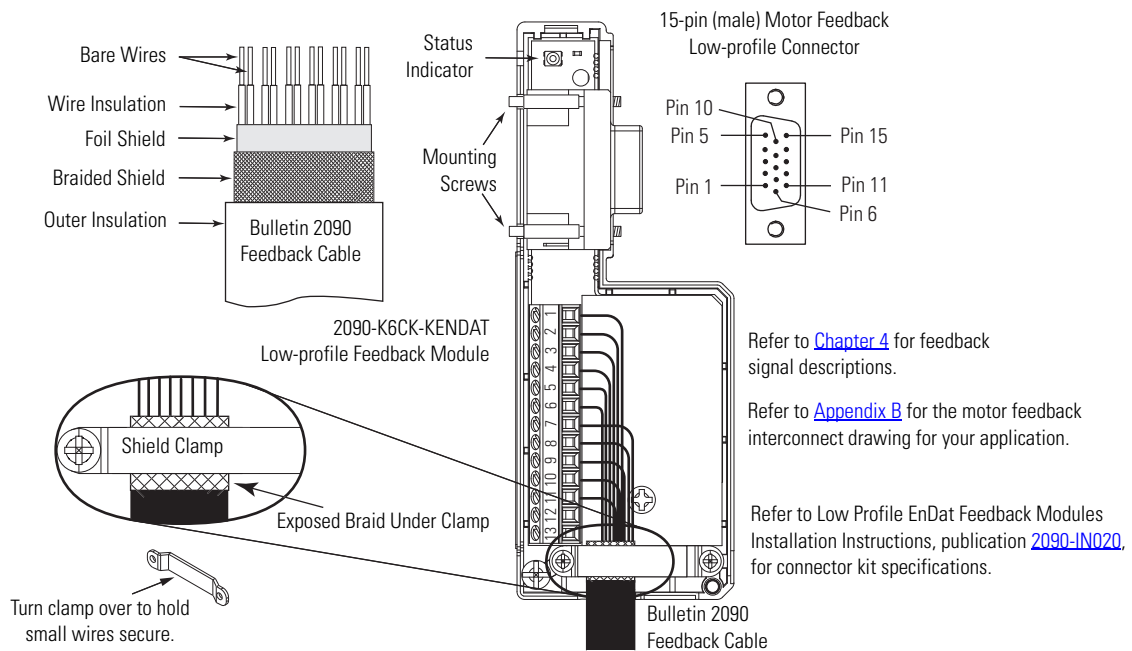
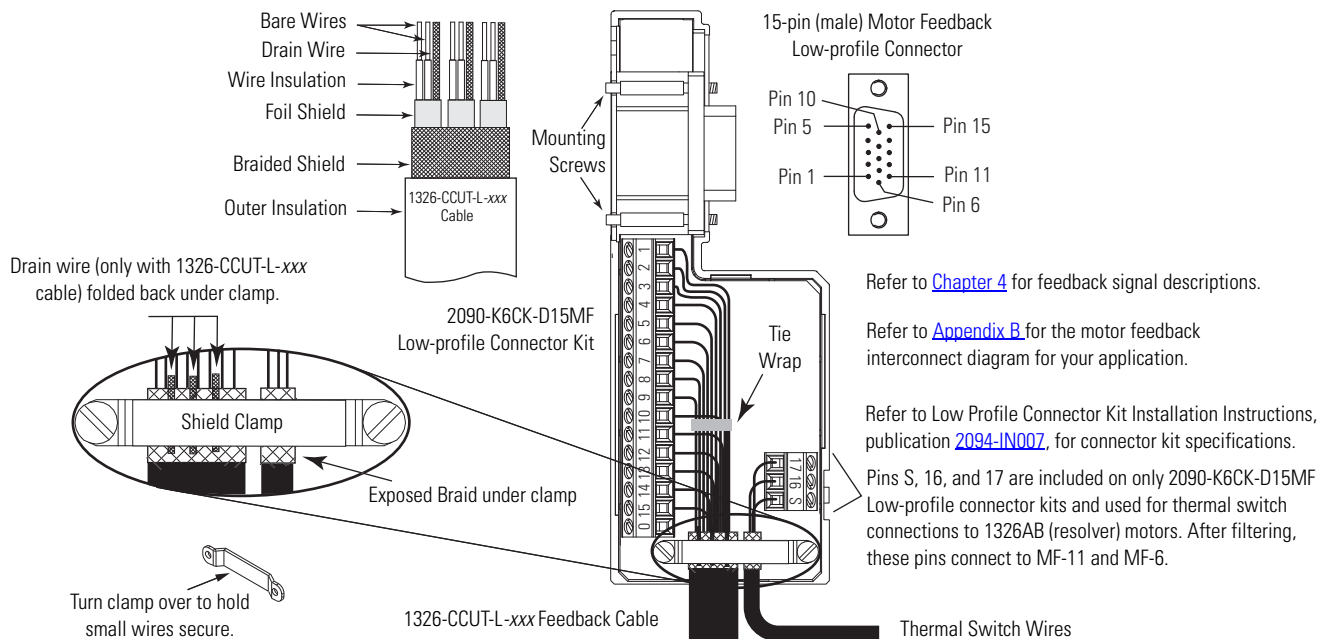


**Figure 65 - Wiring (15-pin) Flying-lead Feedback Cable Connections
2090-K6CK-D15MF Connector Kit**

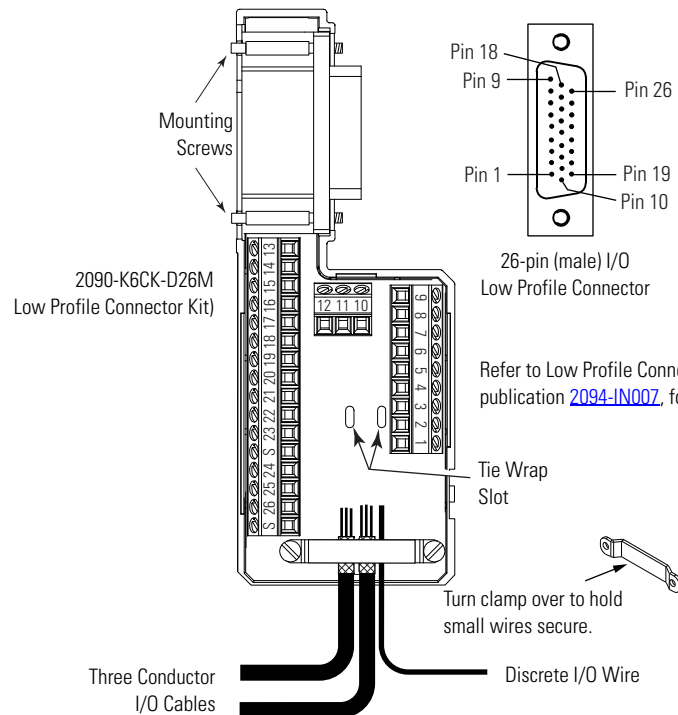


IMPORTANT

The purpose of the cable shield clamp is to provide a proper ground and improve system performance, not stress relief.

Clamping the exposed braid under the shield clamp is critical. Turn clamp over, if necessary, to be sure of a proper ground.

**Figure 66 - Wiring (26-pin) I/O Cable Connections
2090-K6CK-D26M Connector Kit**



External Shunt Module Connections

Follow these guidelines when wiring your external active or passive shunt module.

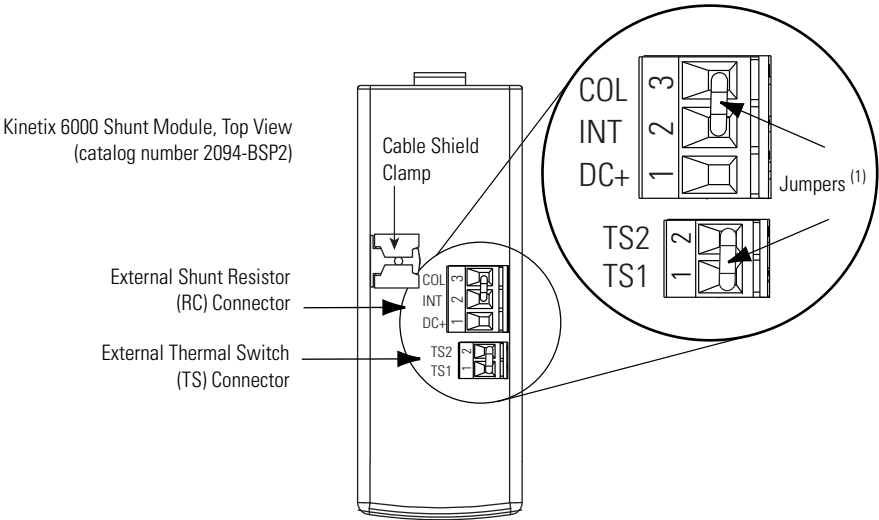
IMPORTANT When tightening screws to secure the wires, refer to the tables beginning on [page 91](#) for torque values.

IMPORTANT To improve system performance, run wires and cables in the wireways as established in [Chapter 2](#).

Figure 67 - Shunt Module Wiring

Use This Shunt Module	Cat. No.	With This Drive Module	Do This
Power rail mounted shunt module.	2094-BSP2	N/A	• Verify the internal shunt jumper is in place between RC-2 and RC-3, as shown in the figure below. • Verify the thermal switch jumper is in place between TS-1 and TS-2, as shown in the figure below.
External passive shunt module connected to the power rail shunt module.	1394-SRxxxx	2094-BSP2 Shunt module	• Remove the internal shunt jumper between RC-2 and RC-3. • Remove the thermal switch jumper between TS-1 and TS-2 (if your shunt module includes a thermal switch). • Refer to External Shunt Modules on page 44 for noise zone considerations. • Refer to Shunt Module Wiring Examples on page 209. • Refer to the installation instructions provided with your Bulletin 1394 shunt module, publication 2090-IN004.
External active shunt module connected to the DC bus.	1336-Wxxxx (requires external resistor)	2094-xCxx-Mxx IAM module	• Refer to External Shunt Modules on page 44 for noise zone considerations. • Refer to Shunt Module Wiring Examples on page 209. • Refer to the installation instructions provided with your Bulletin 1336 chopper module, publication 1336-5.65.

Figure 68 - Shunt Module Jumper Settings



(1) These are the default jumper settings.

RBM Module Connections

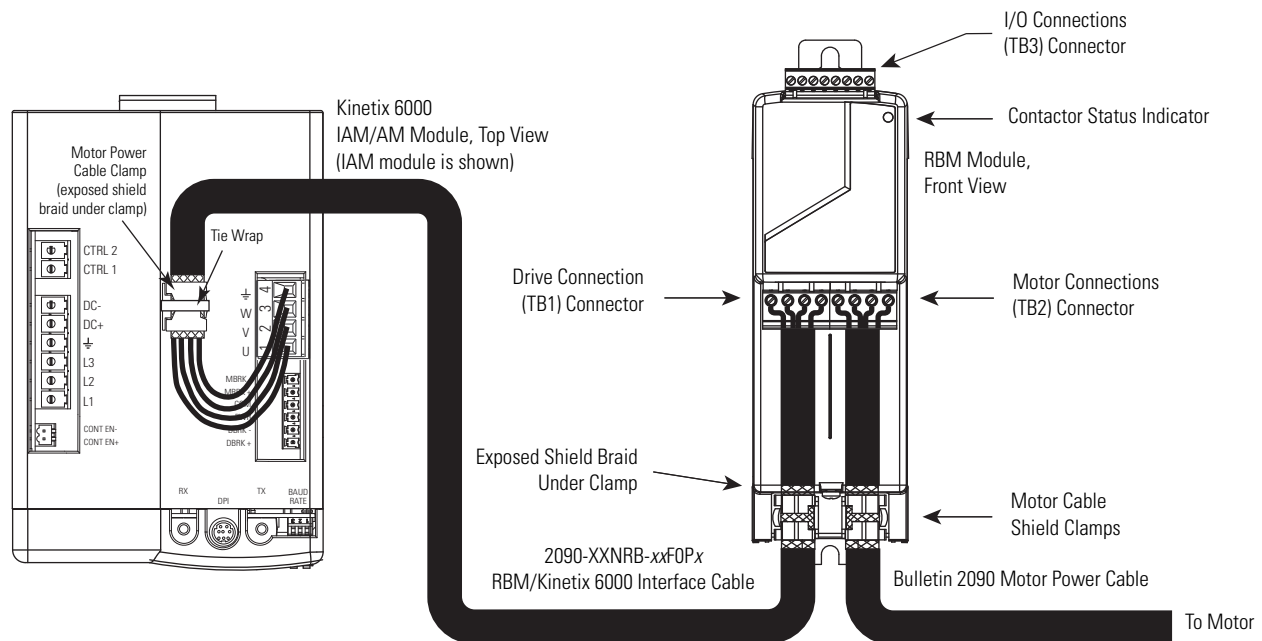
Follow these guidelines when wiring your Bulletin 2090 Resistive Brake Module (RBM).

IMPORTANT To be sure of system performance, run wires and cables in the wireways as established in [Chapter 2](#).

If your application requires an RBM module and you are wiring to a Kinetix 6000 IAM/AM module, then refer to the following:

- Resistive Brake Modules on [page 46](#) to establish noise zones when mounting the RBM module on your panel.
- Resistive brake module to Kinetix 6000 drive interface cable (catalog number 2090-XXNRB-xxF0Px).
- The example diagram below and others in Appendix F, beginning on [page 259](#).
- The installation instructions provided with your RBM module, publication [2090-IN009](#).

Figure 69 - RBM Module Connections



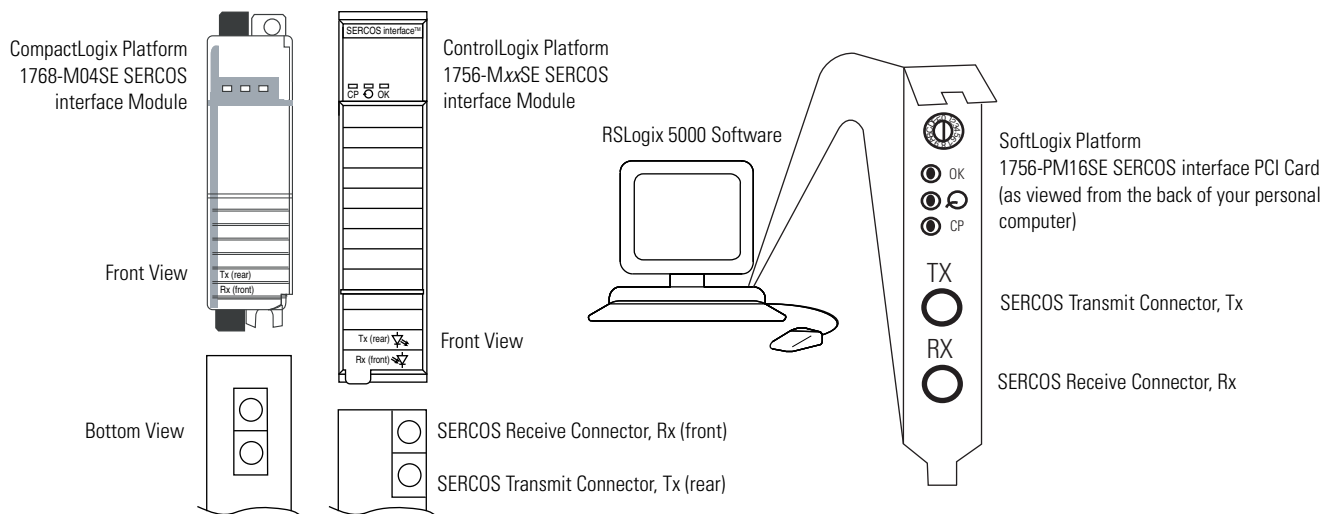
SERCOS Fiber-optic Cable Connections

This procedure assumes you have your Logix SERCOS interface module/PCI card and Kinetix 6000 IAM/AM modules mounted and are ready to connect the fiber-optic cables.

The SERCOS fiber-optic ring is connected by using the SERCOS receive (Rx) and transmit (Tx) connectors. Refer to [page 54](#) to locate the SERCOS connectors on your Kinetix 6000 IAM/AM module. Refer to the figure below to locate the connectors on your Logix SERCOS interface module or PCI card.

Plastic cable is available in lengths up to 32 m (105.0 ft). Glass cable is available in lengths between 50 m (164.2 ft) and 200 m (656.7 ft).

Figure 70 - CompactLogix, ControlLogix, and SoftLogix SERCOS Connector Locations



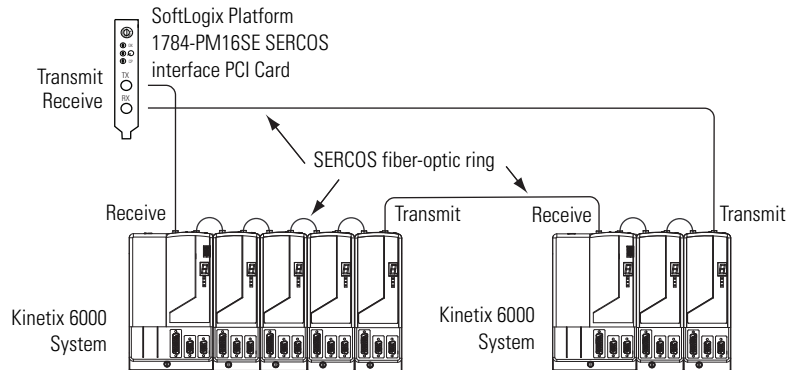
Connect the cable from transmit on the Logix module to receive on the IAM/AM module, then transmit to receive (drive to drive), and from transmit on the last drive back to receive on the Logix module.



ATTENTION: To avoid damage to the SERCOS Rx and Tx connectors use only finger-tight torque when attaching the fiber-optic cables to the Kinetix 6000 IAM/AM modules. Do not use a wrench or any other mechanical assistance.

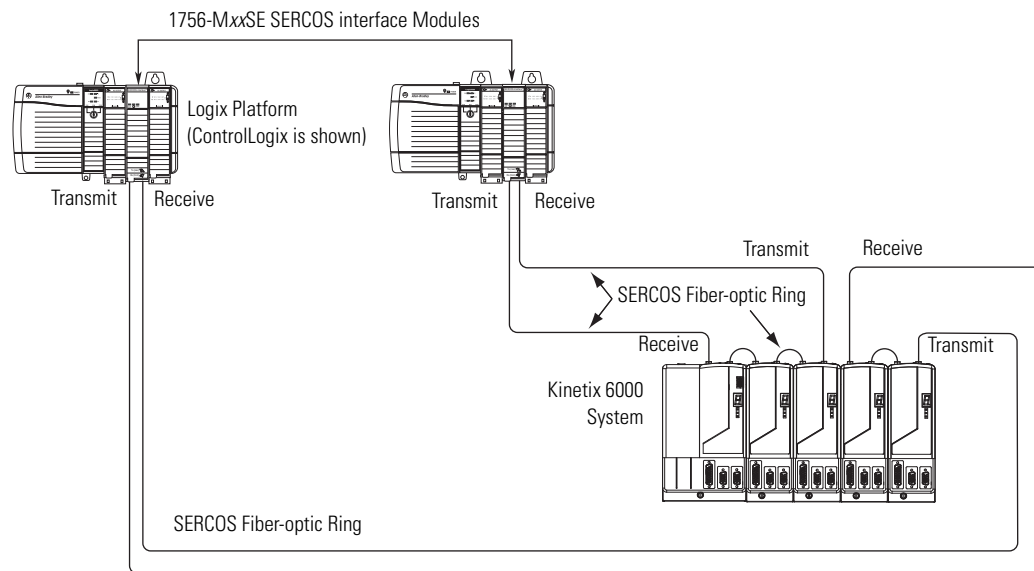
For more information, refer to Fiber-optic Cable Installation and Handling Instructions, publication [2090-IN010](#).

SoftLogix and ControlLogix platforms are used in the following examples; however, the CompactLogix platform connects in the same manner.

Figure 71 - Fiber-optic Cable Example - SoftLogix Platform

IMPORTANT The CompactLogix platform (catalog number 1768-M04SE) is limited to four axes per module.

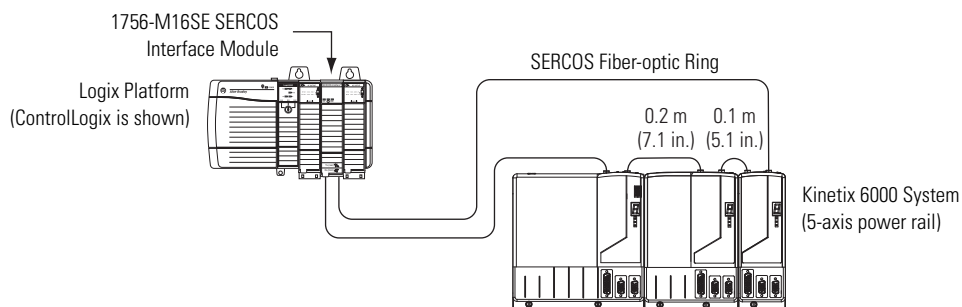
In this example, two Logix modules are installed in separate Logix chassis.

Figure 72 - Fiber-optic Cable Example - Two Logix Platforms

IMPORTANT Clean the fiber-optic cable connectors prior to installation. Dust in the connectors can reduce signal strength. For more information, refer to Fiber-optic Cable Installation and Handling Instructions, publication [2090-IN010](#).

When connecting 2094-BM03-*x* and 2094-BM05-*x* (double-wide) axis modules, use 2090-SCEP0-2, 0.2 m (7.0 in.) cables. When connecting 2094-AM $_{xx-x}$, 2094-BMP5-*x*, 2094-BM01-*x*M, and 2094-BM02-*x* (single-wide) axis modules, use 2090-SCEP0-1, 0.1 m (5.1 in.) cables.

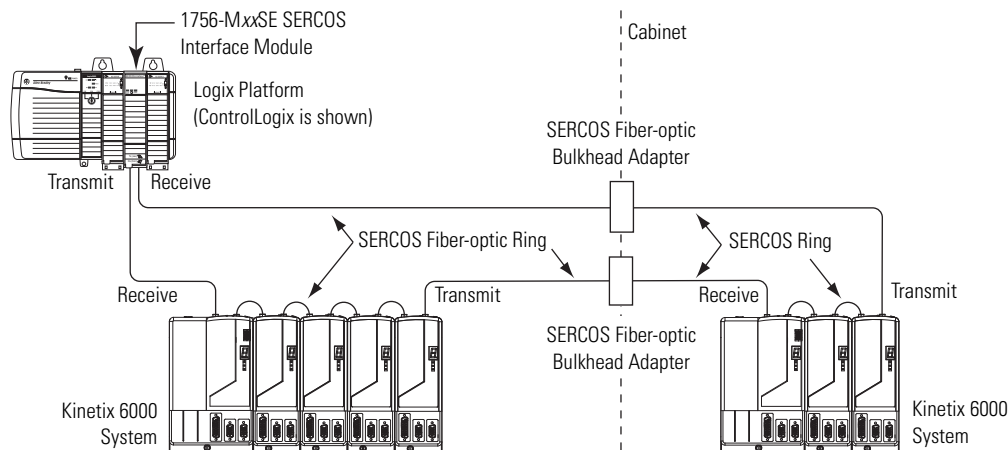
Figure 73 - Fiber-optic Cable Example - Logix Platform with Double-wide Modules



In this example, the second Kinetix 6000 system is located in a separate cabinet and connected with bulkhead adapters.

IMPORTANT To avoid signal loss, do not use bulkhead adapters to connect glass cables. Use only bulkhead adapters for making plastic-to-plastic cable connections.

Figure 74 - Fiber-optic Cable Example - Logix Platform with Bulkhead Adapters



Installing the Fiber-optic Connector Bracket Kit

The fiber-optic connector bracket is designed to relieve stress applied to the Rx and Tx connectors and reduce the possibility of causing damage to the connectors.

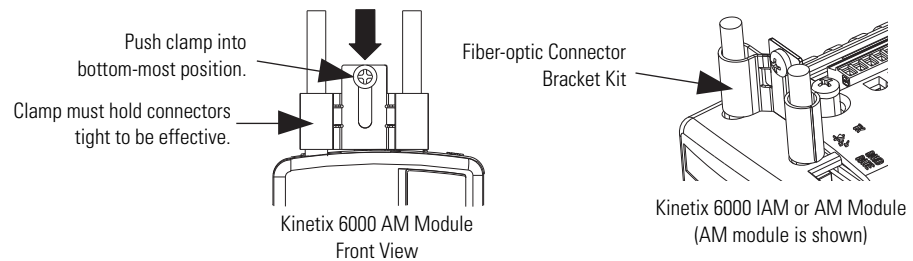


ATTENTION: To avoid damage to the equipment, verify that power is not applied to the system when installing the kit.

Mount the IAM and AM modules to the power rail before attempting to install the brackets.

Clamp must be positioned as shown to be effective. Failure to comply may result in damage to the connectors.

Figure 75 - Fiber-optic Connector Bracket



Notes:

Configure and Start Up the Kinetix 6000 Drive System

Introduction

This chapter provides procedures for configuring your Kinetix 6000 system components with your Logix SERCOS module.

Topic	Page
Introduction	127
Configure the Drive Modules	128
Configure the Logix SERCOS interface Module	133
Apply Power to the Kinetix 6000 Drive	146
Test and Tune the Axes	148
Configure Drive Parameters and System Variables	153

TIP Before you begin, make sure you know the catalog number for each drive component, the Logix module, and the servo motor/actuator in your motion control application.

Configure the Drive Modules

Follow these steps to configure the integrated axis module (IAM) and axis modules (AM).

1. Verify that there is no power applied to the IAM and AM modules and that the communication cables are plugged into the appropriate connectors.

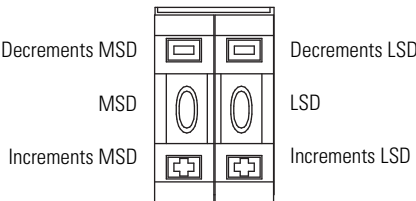
To verify communication, refer to SERCOS Fiber-optic Cable Connections on [page 122](#).

To Configure	Begin With
The IAM module	step 2
Any AM module	step 4

2. Set the base node address for the IAM module by setting the Node Address switches.

Valid node addresses for SERCOS communication are 01...99. The left switch sets the most significant digit (MSD) and the right switch sets the least significant digit (LSD).

To	Press
Increment the (MSD/LSD) node address	The plus (+) switch.
Decrement the (MSD/LSD) node address	The minus (-) switch.



Setting the base node address on the IAM module determines the node address for the IAM (inverter) module. Node addressing for all slot locations on the same power rail increment (from the IAM inverter) left to right. The Kinetix 6200 drives have a private network address of <http://192.168.1.x>, although you do not have to use it.

3. Cycle control power to initialize the IAM module.

IMPORTANT The base node address setting takes effect only after the IAM module is initialized.

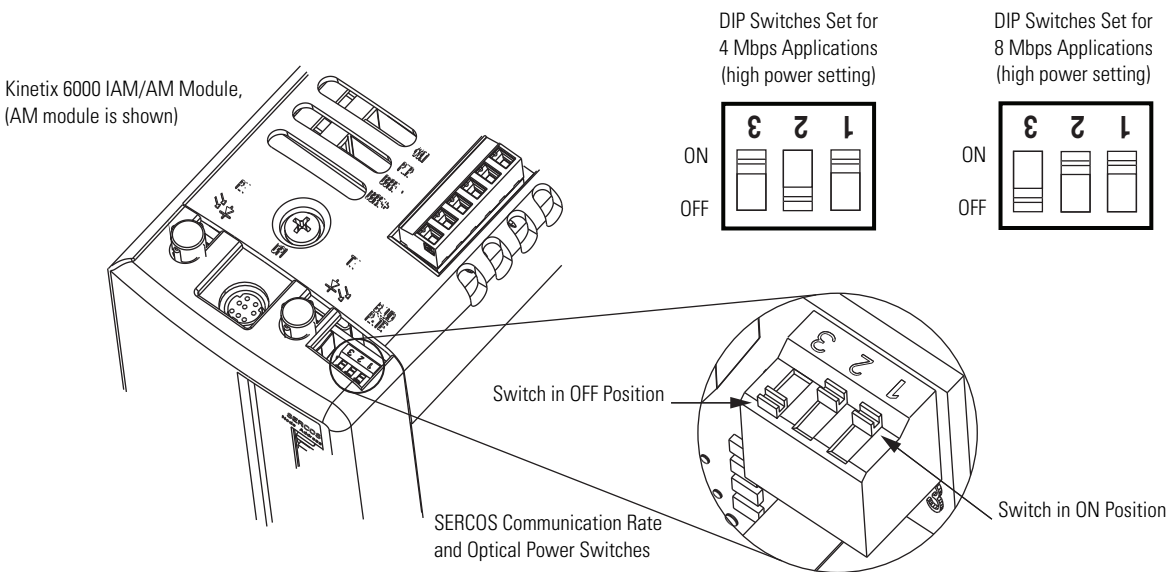
IMPORTANT When two or more IAM modules are connected to the same SERCOS interface module, each node address must be unique. Refer to the node addressing examples beginning on [page 130](#).

4. Set the SERCOS communication rate with DIP switches 2 and 3.

For This Communication Rate	Set Switch 2	Set Switch 3
4 Mbps	OFF	ON
8 Mbps	ON	OFF

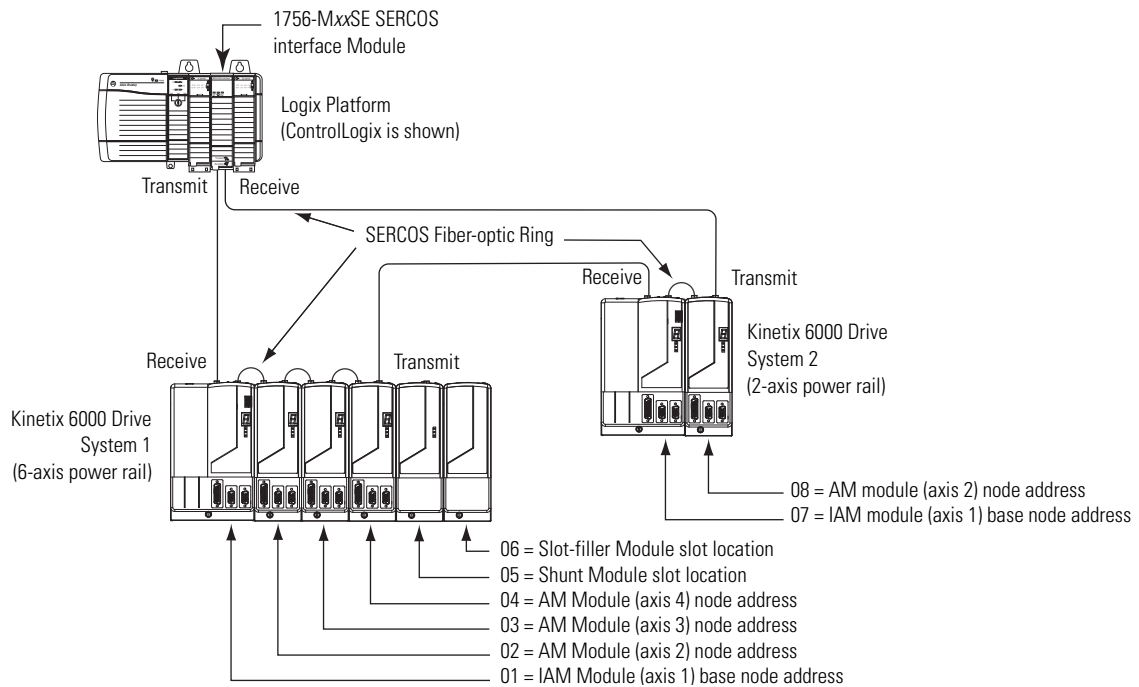
5. Set the SERCOS optical power level to High with DIP switch 1.

For This Optical Power Level	Set Switch 1
Low	OFF
High	ON



6. Repeat [step 4](#) and [step 5](#) for each 2094-*xMxx-x* AM module.

Figure 76 - Node Addressing Example 1



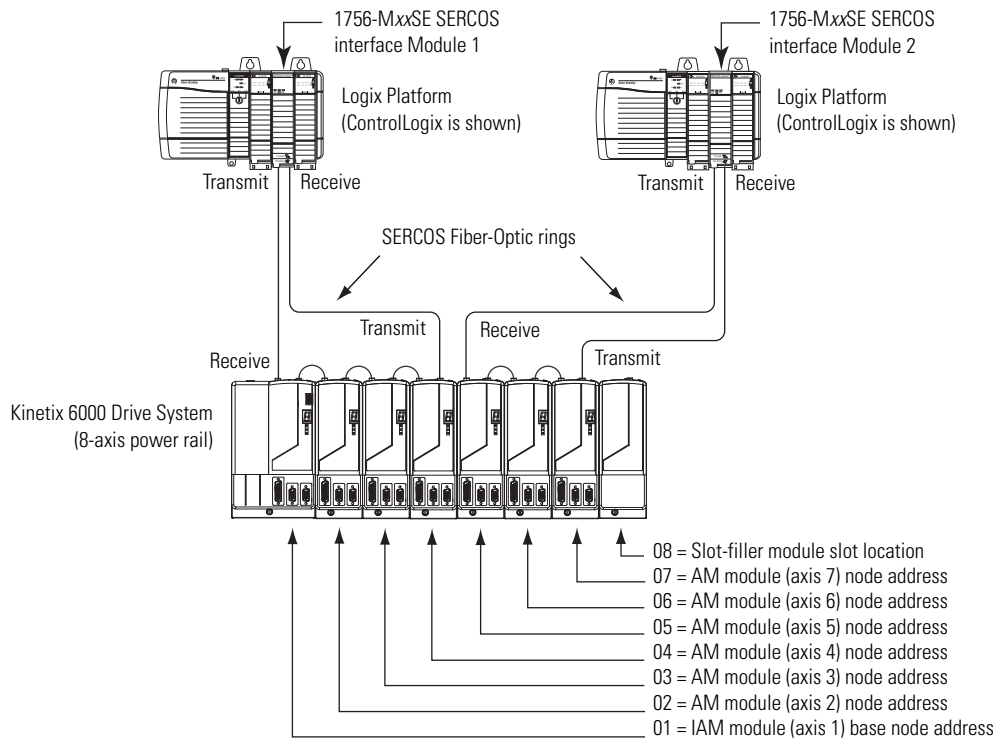
In Example 1, the Kinetix 6000 (6-axis) drive system 1 power rail contains one IAM module, three AM modules, one shunt module, and one slot-filler module. The shunt module and slot-filler modules are not assigned a SERCOS node address, but the system identifies them with a slot location.

Kinetix 6000 (2-axis) drive system 2 power rail contains one IAM module and one AM module. The base node address of the (system 2) IAM module must be set for an address of ≥ 007 .

IMPORTANT The node address for each axis module is determined by the base node-address switch setting on the IAM module.

Do not position axis modules to the right of shunt or slot-filler modules. The added distance between non-adjacent axes can increase electrical noise and impedance, and requires longer fiber-optic cable lengths.

IMPORTANT Slot-filler modules must be used to fill any unoccupied slot on the power rail. However, you can replace slot-filler modules with AM modules or the 2094-BSP2 shunt module (maximum one 2094-BSP2 shunt module per power rail).

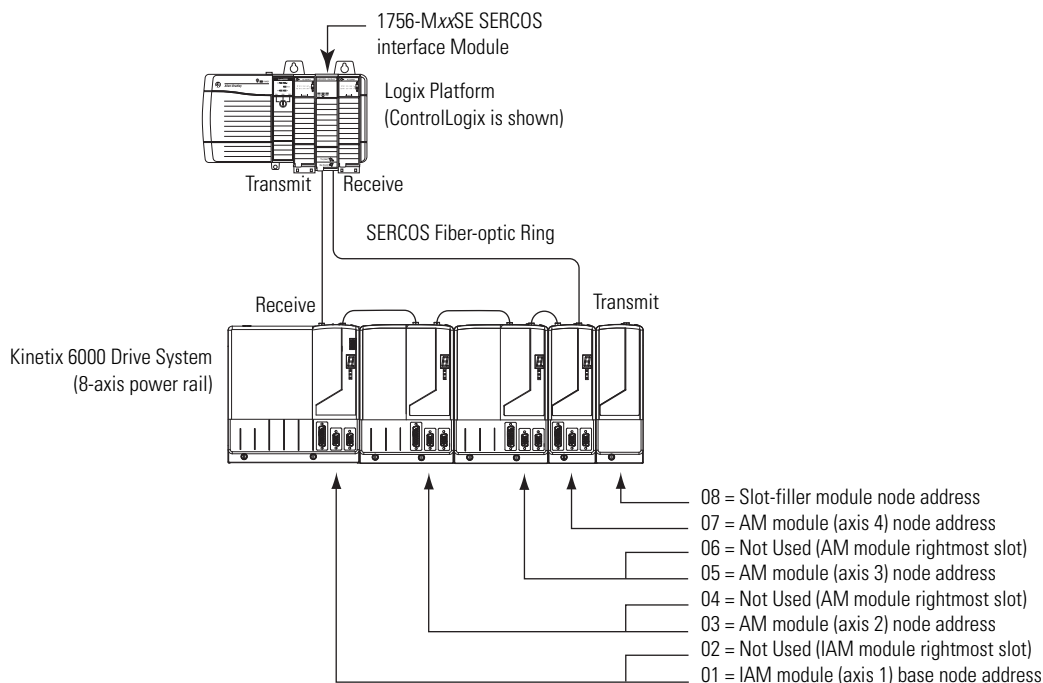
Figure 77 - Node Addressing Example 2

In this example, SERCOS interface module 1 controls axes 1...4 and module 2 controls axes 5...7. The slot-filler module is not assigned a SERCOS node address, but the system identifies it with a slot location.

You can mount the two SERCOS interface modules in two separate ControlLogix chassis (as shown) or you can mount them in the same chassis.

IMPORTANT Slot-filler modules must be used to fill any unoccupied slot on the power rail. However, you can replace slot-filler modules with AM modules or the 2094-BSP2 shunt module (maximum one 2094-BSP2 shunt module per power rail).

Figure 78 - Node Addressing Example 3



In this example, the Kinetix 6000 (8-axis) power rail contains a double-wide IAM module, two double-wide AM modules, one single-wide AM module, and one slot-filler module. The slot-filler module is not assigned a SERCOS node address, but the system identifies it with a slot location.

The leftmost slot of a double-wide module determines the node address. So, in the example above, node addresses 02, 04, and 06 (the rightmost slots of the double-wide modules) are not used.

IMPORTANT Slot-filler modules must be used to fill any unoccupied slot on the power rail. However, the slot-filler modules may also be removed and replaced by an AM or shunt module in the future.

IMPORTANT Do not position axis modules to the right of shunt or slot-filler modules. The added distance between non-adjacent axes can increase electrical noise and impedance, and requires longer fiber-optic cable lengths.

Configure the Logix SERCOS interface Module

This procedure assumes that you have wired your Kinetix 6000 system and have configured the communication rate and optical power switches.

For help using RSLogix 5000 software as it applies to configuring the ControlLogix, CompactLogix, or SoftLogix SERCOS modules, refer to Additional Resources on [page 12](#).

Configure the Logix Controller

Follow these steps to configure the Logix controller.

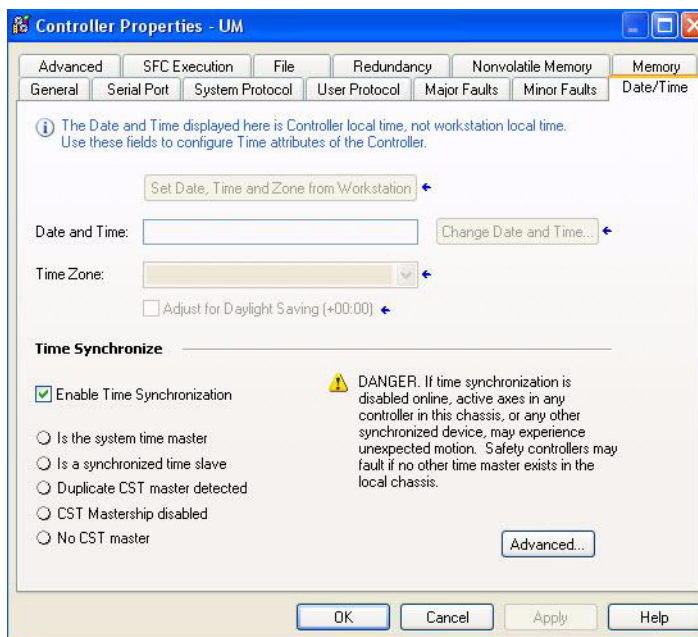
1. Apply power to your Logix chassis containing the SERCOS interface module/PCI card and open your RSLogix 5000 software.
2. From the File menu, choose New.

The New Controller dialog box opens.

The image shows a screenshot of the 'New Controller' dialog box in the RSLogix 5000 software. The dialog box has a title bar with 'New Controller' and a close button. It contains several fields and buttons. The 'Vendor' field is set to 'Allen-Bradley'. The 'Type' field is a pull-down menu showing '1756-L63 ControlLogix5563 Controller'. The 'Revision' field is a pull-down menu showing '18'. There is a checkbox for 'Redundancy Enabled' which is currently unchecked. The 'Name' field is a text box containing 'UM_SERCOS'. The 'Description' field is a text box that is currently empty. The 'Chassis Type' field is a pull-down menu showing '1756-A4 4-Slot ControlLogix Chassis'. The 'Slot' field is a pull-down menu showing '0'. There is a text box for 'Safety Partner Slot' which contains '<none>'. The 'Create In' field is a text box containing 'C:\RSLogix 5000\Projects'. There are buttons for 'OK', 'Cancel', 'Help', and 'Browse...'. The 'Browse...' button is next to the 'Create In' field.

3. Configure the new controller.
 - a. From the Type pull-down menu, choose the controller type.
 - b. From the Revision pull-down menu, choose the revision.
 - c. Type the file Name.
 - d. From the Chassis Type pull-down menu, choose the chassis.
 - e. Enter the Logix processor slot.
4. Click OK.
5. From the Edit menu, choose Controller Properties.

The Controller Properties dialog box opens.



6. Click the Date/Time tab.
7. Check Enable Time Synchronization.

This assigns the controller as the Grandmaster clock. The motion modules set their clocks to the module you assign as the Grandmaster.

IMPORTANT You can assign only one module in the Logix chassis as the Grandmaster clock.

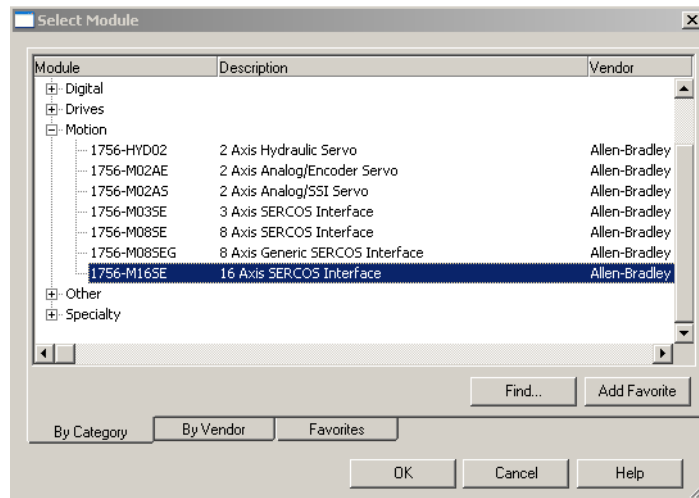
8. Click OK.

Configure the Logix Module

Follow these steps to configure the Logix module.

1. Right-click I/O Configuration in the Controller Organizer and choose New Module.

The Select Module dialog box opens.

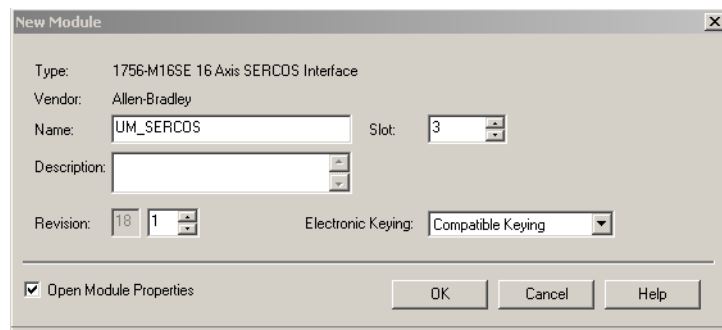


2. Expand the Motion category and select 1756-MxxSE, 1756-L60M03SE, 1768-M04SE, or 1784-PM16SE as appropriate for your actual hardware configuration.

In this example, the 1756-M16SE module is selected.

3. Click OK.

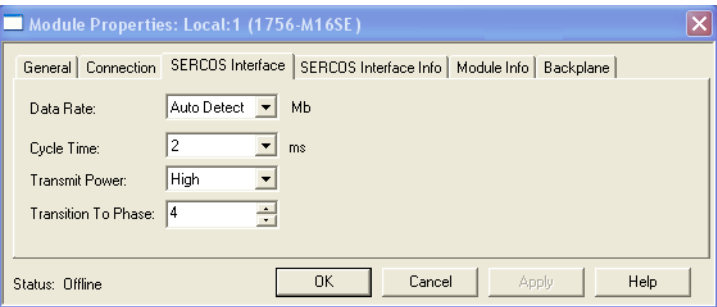
The New Module dialog box opens.



4. Configure the new module.
 - a. Type the module Name.
 - b. Enter the Logix SERCOS module slot (leftmost slot = 0).
 - c. Check Open Module Properties.
5. Click OK.

Your new module appears under the I/O Configuration folder in the Controller Organizer and the Module Properties dialog box opens.

6. Click the SERCOS Interface tab and reference the table below.



Logix SERCOS Module	Number of Axes	Data Rate
1756-M03SE or 1756-L60M03SE	Up to 3	4 or 8 Mbps
1756-M08SE	Up to 8	
1756-M16SE or 1784-PM16SE	Up to 16	
1768-M04SE	Up to 4	

7. Verify that the Data Rate setting matches DIP switches 2 and 3 (communication rate), as set on the IAM and AM module, or choose the Auto Detect setting.
8. From the Cycle Time pull-down menu, choose the Cycle Time according to the table below.

Data Rate	Number of Axes	Cycle Time
4 Mbps	Up to 2	0.5 ms
	Up to 4	1 ms
	Up to 8	2 ms
	No support for axes 9...16	
8 Mbps	Up to 4	0.5 ms
	Up to 8	1 ms
	Up to 16	2 ms

TIP The number of axes/module is limited to the number of axes as shown in [step 6](#).

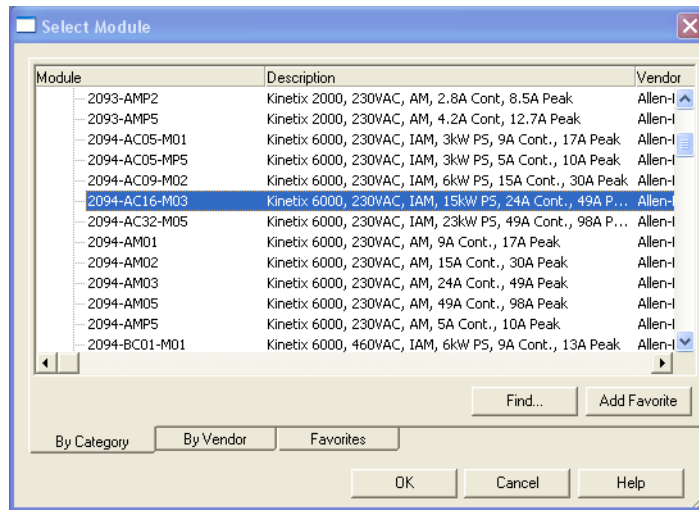
9. Verify that the Transmit Power setting (high or low) matches Optical Power DIP switch 1 as set on the IAM and AM modules.
10. Enter the Transition to Phase setting.
- The Transition to Phase default setting is 4 (phase 4). The Transition to Phase setting stops the ring in the phase specified.
11. Click OK.
12. Repeat [step 1](#)...[step 11](#) for each Logix module.

Configure the Kinetix 6000 Drive Modules

Follow these steps to configure the Kinetix 6000 drive modules.

1. Right-click the Logix module you just created and choose New Module.

The Select Module dialog box opens.



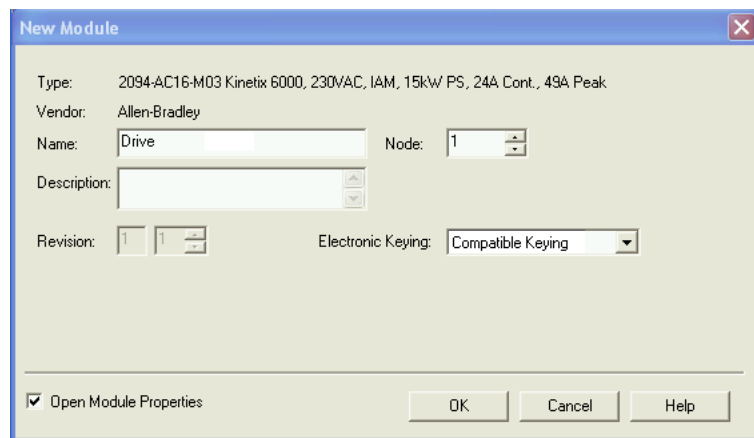
2. Expand the Drives category and select drive components appropriate for your actual hardware configuration.

IMPORTANT

In order for the Kinetix 6000 drive to communicate with the SERCOS interface module (indicated by three solid-green status indicators on the SERCOS module), you must be using RSLogix 5000 software, version 11.0 or later.

3. Click OK.

The New Module dialog box opens.

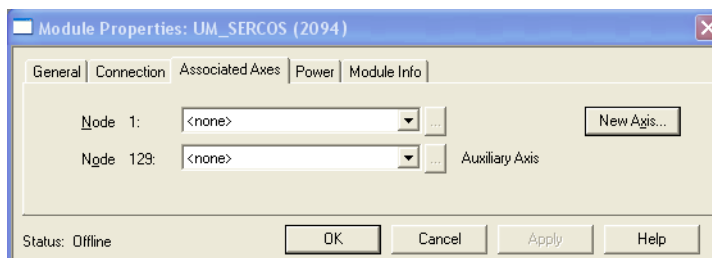


4. Configure the new module.

- a. Type the module Name.
- b. Enter the Node address.

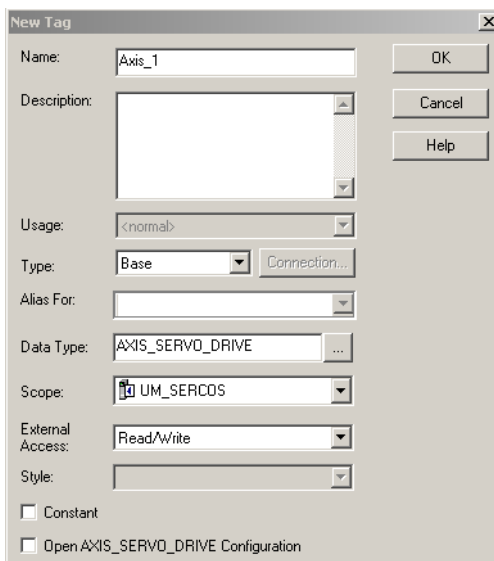
Set the node address in the software to match the node setting on the drive. Refer to Configure the Drive Modules, [step 2](#), on [page 128](#).

- c. Check Open Module Properties.
- 5.** Click OK.
- 6.** Click the Associated Axes tab.



7. Click New Axis.

The New Tag dialog box opens.



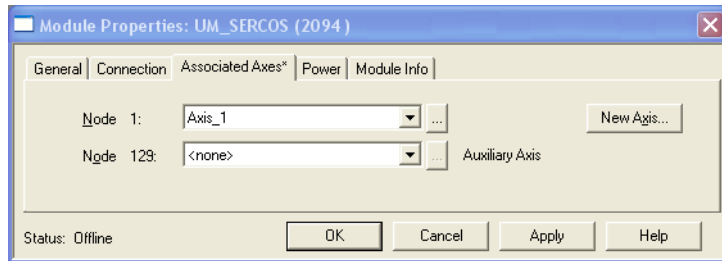
8. Type the axis Name.

AXIS_SERVO_DRIVE is the default Data Type.

9. Click OK.

The axis appears under the Ungrouped Axes folder in the Controller Organizer.

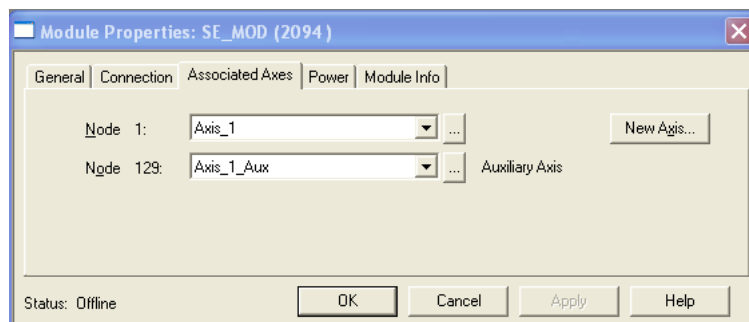
10. Assign your axis to Node 1.



11. Click Apply.

TIP

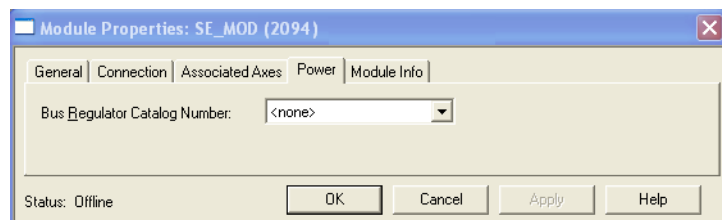
With drive firmware revision 1.80 or later, and RSLogix 5000 software version 13 or later, it is possible to configure the Auxiliary Axis feedback port as a Feedback Only axis. With this feature, you can configure each IAM inverter or AM module to appear as two axes/nodes on the SERCOS ring. The base node is the servo axis utilizing the motor feedback, and the base node (plus 128) is a feedback-only axis using the auxiliary feedback port.



The Auxiliary Axis (Node 129) is configured identically to Node 1 by clicking New Axis and creating a new tag.

12. Click Apply if you made changes.

13. Click the Power tab.



14. From the Bus Regulator Catalog Number pull-down menu, choose the shunt option appropriate for your actual hardware configuration.

If your IAM module is	And your hardware configuration includes this shunt option	Then choose
Configured as an IAM module or common-bus leader IAM module ⁽¹⁾	Internal shunt resistors only	Internal or <none>
	Bulletin 2094 (rail mounted) shunt module	2094-BSP2
	Bulletin 1394 passive shunt module (connected to the 2094-BSP2 shunt module)	1394-SRxxxx
	Bulletin 1336 active shunt module	Internal or <none>
Configured as a common-bus follower IAM module ⁽²⁾	N/A. Shunts are disabled on follower IAM module	CommonBus Follow

(1) Drive will not accept Internal, <none>, 2094-BSP2, or 1394-SRxxxx selection if DC bus voltage is present without having three-phase power applied.

(2) Drive will not accept CommonBus Follow selection if three-phase power or DC bus power is applied.



To avoid damage to your Bulletin 1394 external shunt module when wired to the 2094-BSP2 shunt module, verify that the proper 230V or 460V fuse is installed prior to applying power.

Refer to External Shunt Module Specifications on [page 194](#), for more information.

IMPORTANT

When configured to use the Bulletin 1394 or 2094 shunt modules, the IAM bus regulator capacity attribute displays the utilization of total shunt power available (as a percent) based on the power rail configuration. Refer to External Shunt Module Specifications on [page 194](#) for shunt power specification and examples.

IMPORTANT

DC common-bus applications must calculate Total Bus Capacitance and Additional Bus Capacitance and set the Add Bus Cap parameter in the leader IAM module by using DriveExplorer or RSLogix 5000 software. Refer to Appendix D beginning on [page 245](#), for more information on making the calculations. Refer to Appendix E beginning on [page 253](#), for more information on setting the Add Bus Cap parameter.

15. Click OK.

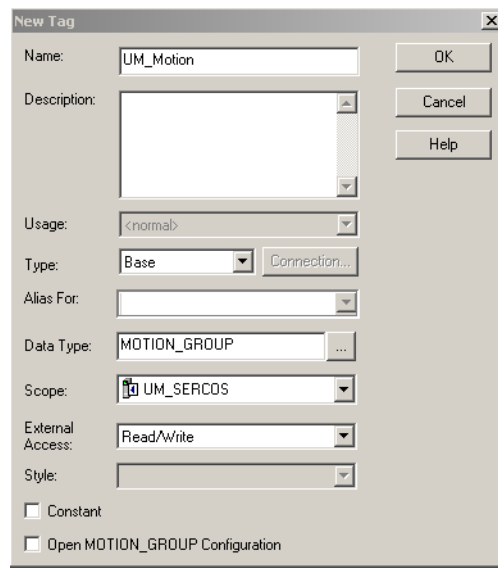
16. Repeat [step 1](#)...[step 10](#) for each Bulletin 2094 AM module.

Configure the Motion Group

Follow these steps to configure the motion group.

1. Right-click Motion Groups in the Controller Organizer and choose New Motion Group.

The New Tag dialog box opens.

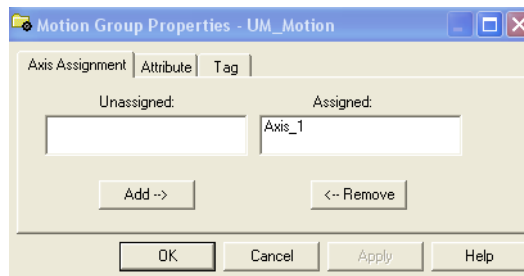


2. Type the new motion group Name.
3. Click OK.

The new motion group appears under the Motion Groups folder.

4. Right-click the new motion group and choose Properties.

The Motion Group Properties dialog box opens.



5. Click the Axis Assignment tab and move your axes (created earlier) from Unassigned to Assigned.
6. Click the Attribute tab and edit the default values as appropriate for your application.
7. Click OK.

Configure Axis Properties

The peak current ratings of the Kinetix 6000 AM modules (series A and B) are configured at the factory as 150% of continuous current. You can program 460V (series B) AM modules and the equivalent IAM (inverter) modules, for up to 250% of continuous inverter current.

Table 79 - Kinetix 6000 Series Change

IAM Module Cat. No.	AM Module Cat. No.	Peak Current Rating	
		Series A (inverter)	Series B (inverter)
2094-BC01-MP5-S	2094-BMP5-S	150%	250%
2094-BC01-M01-S	2094-BM01-S	150%	250%
2094-BC02-M02-S	2094-BM02-S	150%	250%
2094-BC04-M03-S	2094-BM03-S	150%	250%
2094-BC07-M05-S	2094-BM05-S	150%	200%

IMPORTANT

Before your drive will deliver increased peak performance, you must enable the peak enhancement feature by configuring your drive with DriveExplorer or RSLogix 5000 software.

Refer to the interactive Peak Enhancement Configuration Utility to recalculate torque and accel/decel limit values, and paste them into the appropriate Axis Properties dialog box. To download the utility, go to <http://www.ab.com/motion/software/peak.html>.

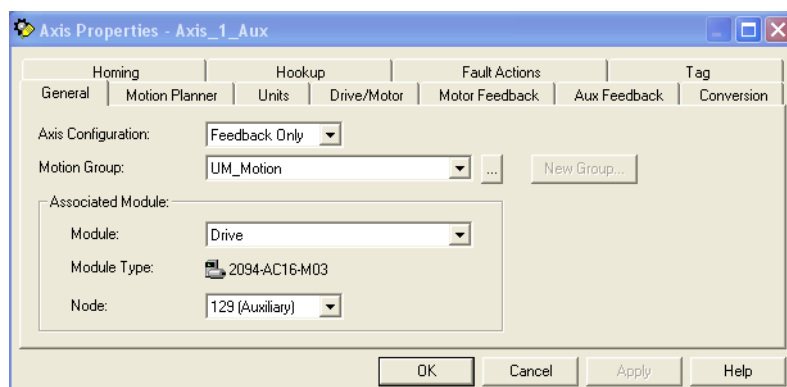
For sizing your drive/motor combination with series-B drives and the peak enhancement feature, use Motion Analyzer software version 4.6 or later.

Follow these steps to configure the Auxiliary Axis properties.

1. Right-click an auxiliary axis in the Controller Organizer and choose Properties.

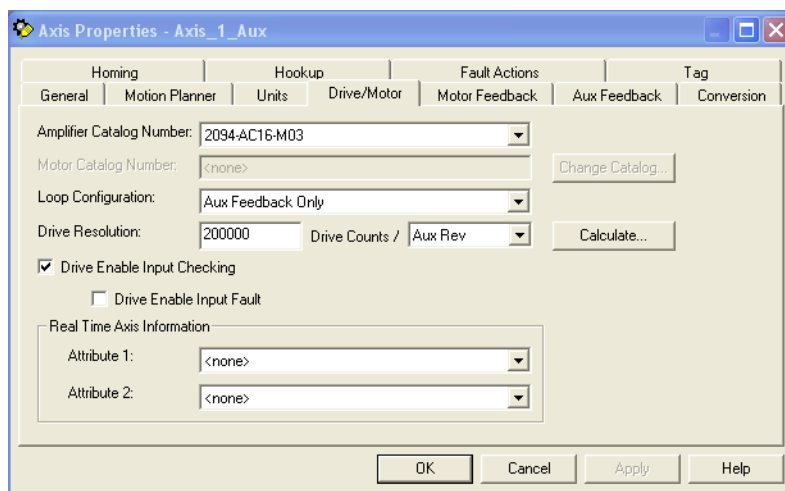
The Axis Properties dialog box opens on the General tab.

If an axis is associated to the auxiliary axis node, set the Axis Configuration on the General tab of the Axis Properties dialog box to Feedback Only.

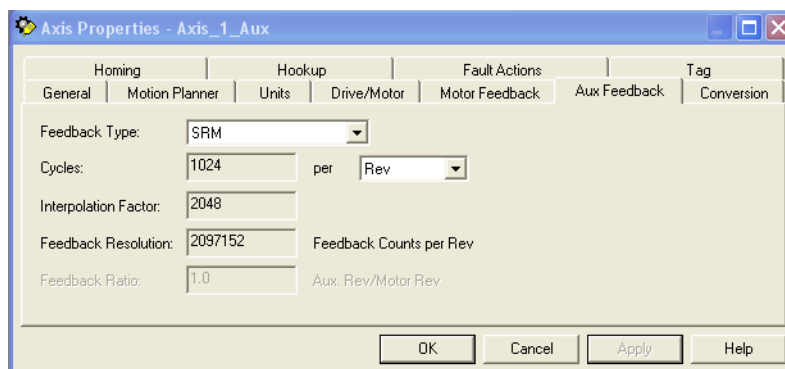


2. Click the Drive/Motor tab.

The Drive/Motor tab displays the amplifier being used and the Loop Configuration is Aux Feedback Only. This is the only choice if the amplifier is using the primary node for Servo (motor) configuration.



3. Click the Aux Feedback tab.



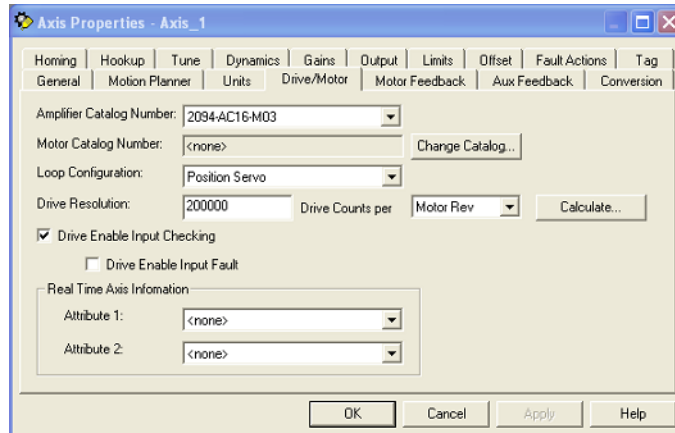
IMPORTANT The Aux Feedback tab must be configured for the auxiliary feedback type being used. In this example, an SRM feedback device is being used.

4. From the Feedback Type pull-down menu, choose the feedback type appropriate for your auxiliary feedback motor.
5. Click Apply.

Follow these steps to configure the Axis properties.

1. Right-click an axis in the Controller Organizer and choose Properties.

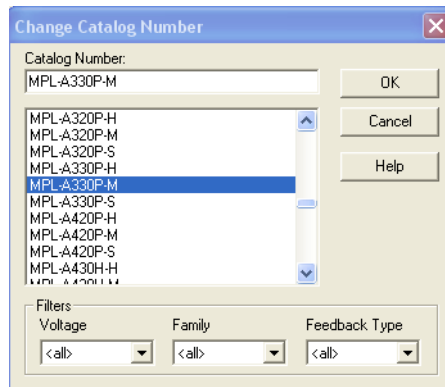
The Axis Properties dialog box opens.



2. Click the Drive/Motor tab.

3. Click Change Catalog.

The Change Catalog Number dialog box opens.



4. Select the motor catalog number appropriate for your application.

To verify the motor catalog number, refer to the motor name plate.

5. Click OK.

6. On the Drive/Motor tab, check Drive Enable Input Checking.

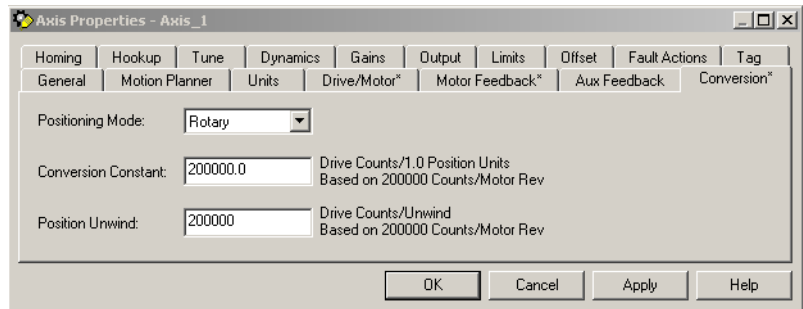
When checked (default), means a hard drive-enable input signal is required. Uncheck to remove that requirement.

7. Click Apply.

8. Click the Motor Feedback tab and verify the Feedback Type shown is appropriate for your actual hardware configuration.

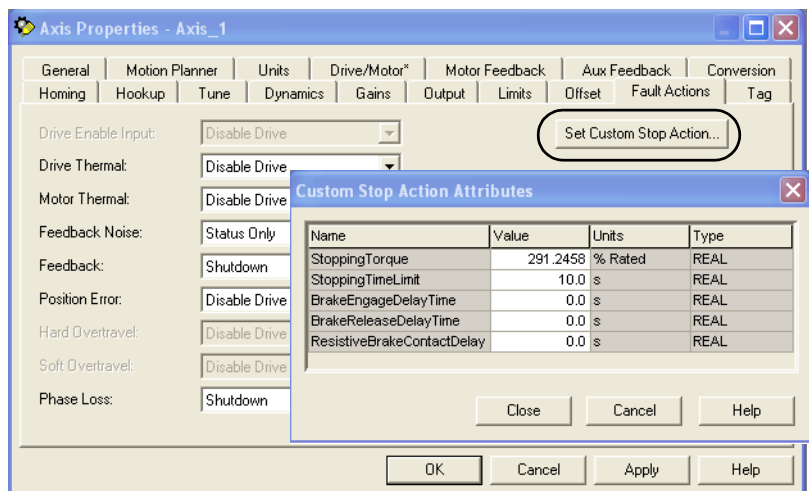
9. Click the Units tab and edit default values as appropriate for your application.

10. Click the Conversion tab and edit default values as appropriate for your application.



In this example, Rotary is chosen from the Positioning Mode pull-down menu.

11. Click Apply if you made changes.
12. Click the Fault Actions tab.



13. Click Set Custom Stop Action.

The Custom Stop Action Attributes dialog box opens and lets you set delay times for servo motors and RBM modules. For recommended motor brake delay times, refer to the Kinetix Motion Control Selection Guide, publication [GMC-SG001](#).

14. Configure the delay times.
 - a. Type the Brake Engage Delay Time.
 - b. Type the Brake Release Delay Time.
 - c. Set the Resistive Brake Contact Delay time (0 - 1000 ms range).

TIP The recommended delay time for 2090-XB33-xx and 2090-XB120-xx RBM modules is 71 ms.

- d. Click Close.
15. Click OK.

- 16. Repeat [step 1...step 15](#) for each Bulletin 2094 AM module.
- 17. Verify your Logix program and save the file.

Download the Program

After completing the Logix configuration you must download your program to the Logix processor.

Apply Power to the Kinetix 6000 Drive

This procedure assumes that you have wired and configured your Kinetix 6000 system (with or without the LIM module) and your SERCOS interface module.



SHOCK HAZARD: To avoid hazard of electrical shock, perform all mounting and wiring of the Bulletin 2094 power rail and drive modules prior to applying power. Once power is applied, connector terminals may have voltage present even when not in use.

Refer to the Line Interface Module Installation Instructions, publication [2094-IN005](#), when troubleshooting the LIM module status indicators, and for the location of LIM module circuit breakers, connectors, and status indicators.

Follow these steps to apply power to the Kinetix 6000 drive system.

- 1. Disconnect the load to the motor.

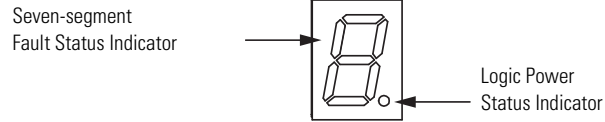


ATTENTION: To avoid personal injury or damage to equipment, disconnect the load to the motor. Make sure each motor is free of all linkages when initially applying power to the system.

- 2. Determine your source of control power.

If Your Control Power	Then
Is sourced from a LIM module	1. Verify that CB1, CB2, and CB3 are in the OFF position. 2. Apply three-phase input power to the LIM module VAC Line connector. 3. Set CB3 to the ON position. 4. Set CB2 to the ON position. 5. Go to main step 3.
Is not sourced from a LIM module	1. Apply (95...264V AC) control power to the IAM module (CPD connector). 2. Go to main step 3.

3. Observe the IAM/AM module logic power status indicator.



If the Logic Power Indicator is	Then
ON	Go to step 4 .
Not ON	1. Check your control power connections. 2. Go back to main step 2.

4. Determine your source of three-phase input power.

If Your Three-phase Power	Then
Is sourced from a LIM module	1. Set CB1 to the ON position. 2. Verify the Hardware Enable Input signal (IOD-2) for each axis is at 0 volts. Remove the connection between IOD-1 and IOD-2 if one exists. 3. Go to main step 5.
Is not sourced from a LIM module	1. Apply 195...265V AC (230V) or 324...528V AC (460V) input power to the IAM module (IPD connector). 2. Verify the Hardware Enable Input signal (IOD-2) for each axis is at 0 volts. Remove the connection between IOD-1 and IOD-2 if one exists. 3. Go to main step 5.

5. Observe the IAM/AM module fault status indicator.

The status indicator will first flash the SERCOS node address, then cycle through phases until final configuration (phase 4) is reached.

IAM/AM Fault Status Indicator	Status	Do This
Actively cycling (phase 0)	The drive is looking for a closed SERCOS ring. Wait for phase 1 or take corrective action until you reach phase 1.	Check fiber-optic connections.
Displaying a fixed 1 (phase 1)	The drive is looking for active nodes. Wait for phase 2 or take corrective action until you reach phase 2.	Check node addressing.
Displaying a fixed 2 (phase 2)	The drive is configuring nodes for communication. Wait for phase 3 or take corrective action until you reach phase 3.	Check program motor and drive configuration against installed hardware.
Displaying a fixed 3 (phase 3)	The drive is configuring device specific parameters. Wait for phase 4 or take corrective action until you reach phase 4.	Check motor catalog number against selection. ⁽¹⁾
Displaying a fixed 4 (phase 4)	The drive is configured and active.	Go to step 6 .
Flashing an E followed by two numbers	Drive is faulted.	Go to Error Codes on page 158 .

(1) You can get diagnostic information from the module by highlighting the module name in RSLogix 5000 software. A Pseudo Key Failure often indicates that the motor selection does not match the motor installed.

6. Observe the status indicators on the front of the IAM/AM module.
Refer to troubleshooting tables for the Drive, Comm, and Bus status indicators in IAM/AM Module Status Indicators on [page 164](#).
7. Observe the three SERCOS indicators on the Logix SERCOS module.

Three SERCOS Indicators	Status	Do This
Flashing green and red	Establishing communication	Wait for steady green on all three indicators.
Steady green	Communication ready	Go to Test and Tune the Axes on page 148 .
Not flashing green and red/ not steady green	SERCOS module is faulted	Go to the appropriate Logix manual for specific instructions and troubleshooting.

Test and Tune the Axes

This procedure assumes that you have configured your Kinetix 6000 drive, your Logix SERCOS interface module, and applied power to the system.

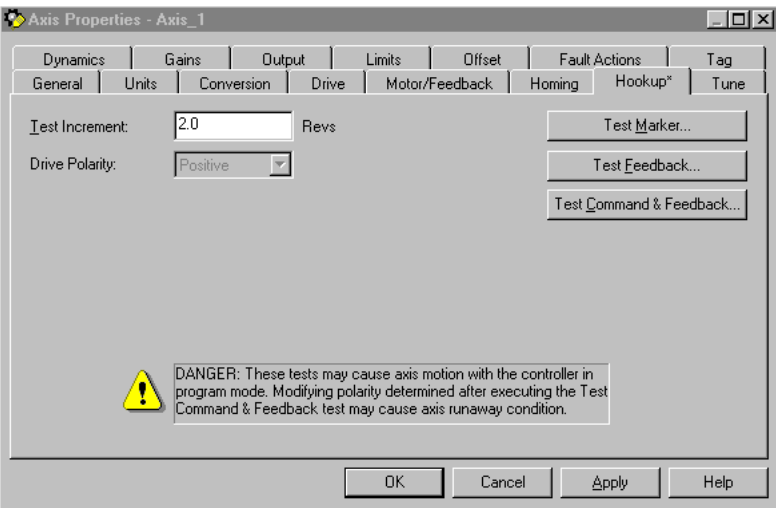
For help using RSLogix 5000 software as it applies to testing and tuning your axes with ControlLogix, CompactLogix, or SoftLogix SERCOS modules, refer to Additional Resources on [page 12](#).

Test the Axes

Follow these steps to test the axes.

1. Verify the load was removed from each axis.
2. Right-click an axis in your Motion Group folder and choose Properties.

The Axis Properties dialog box opens.



3. Click the Hookup tab.

4. Type 2.0 as the number of revolutions for the test or another number more appropriate for your application.

This Test	Performs this Test
Test Marker	Verifies marker detection capability as you rotate the motor shaft.
Test Feedback	Verifies feedback connections are wired correctly as you rotate the motor shaft.
Test Command & Feedback	Verifies motor power and feedback connections are wired correctly as you command the motor to rotate. Also, lets you define polarity.

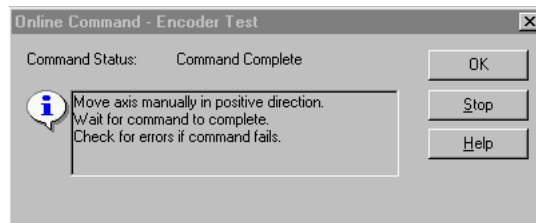
5. Apply Hardware Enable Input signal (IOD-2) for the axis you are testing.



ATTENTION: To avoid personal injury or damage to equipment, apply 24V ENABLE signal (IOD-2) only to the axis you are testing.

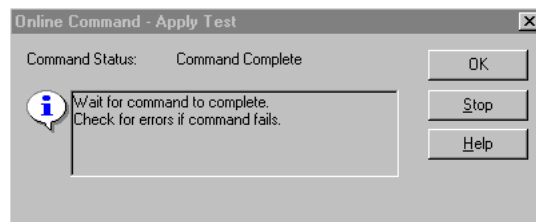
6. Select the desired Test (Marker/Feedback/Command & Feedback) to verify connections.

The Online Command dialog box opens. Follow the on-screen test instructions. When the test completes, the Command Status changes from Executing to Command Complete.



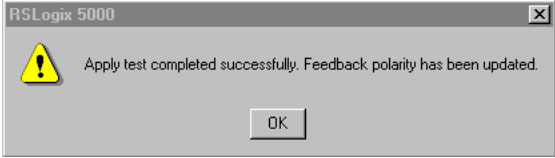
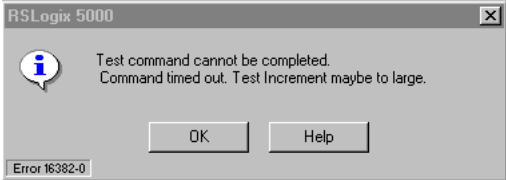
7. Click OK.

The Online Command - Apply Test dialog box opens (Feedback and Command & Feedback tests only). When the test completes, the Command Status changes from Executing to Command Complete.



8. Click OK.

9. Determine if your test completed successfully.

If	Then
Your test completes successfully, this dialog box opens. 	1. Click OK. 2. Remove Hardware Enable Input signal (IOD-2). 3. Go to Tune the Axes on page 150.
Your test failed, this dialog box opens. 	1. Click OK. 2. Verify the Bus status indicator turned solid green during the test. 3. Verify that the Hardware Enable Input signal (IOD-2) is applied to the axis you are testing. 4. Verify conversion constant entered in the Conversion tab. 5. Return to main step 6 and run the test again.

Tune the Axes

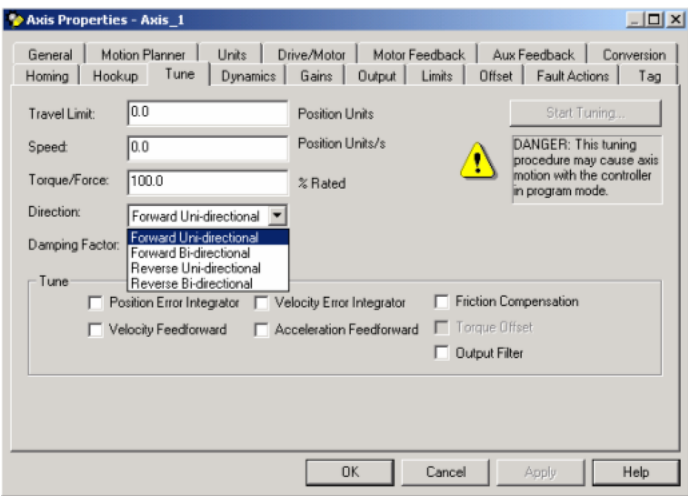
Follow these steps to tune the axes.

1. Verify the load is still removed from the axis being tuned.



ATTENTION: To reduce the possibility of unpredictable motor response, tune your motor with the load removed first, then re-attach the load and perform the tuning procedure again to provide an accurate operational response.

2. Click the Tune tab.



3. Type values for Travel Limit and Speed.

In this example, Travel Limit = 5 and Speed = 10. The actual value of programmed units depend on your application.

4. From the Direction pull-down menu, choose a setting.

Forward Uni-directional is default.

5. Check Tune boxes as appropriate for your application.

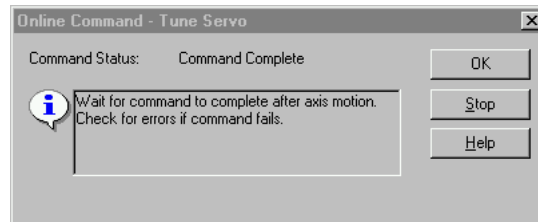
6. Apply Hardware Enable Input signal (IOD-2) for the axis you are tuning.



ATTENTION: To avoid personal injury or damage to equipment, apply 24V ENABLE signal (IOD-2) only to the axis you are tuning.

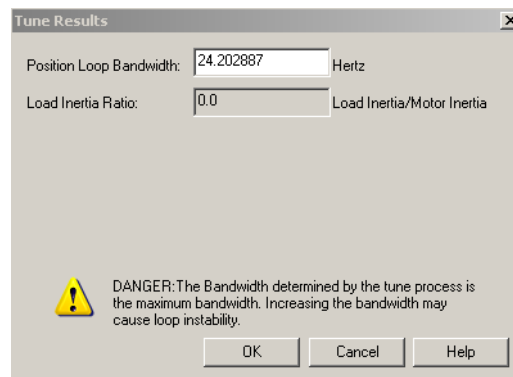
7. Click Start Tuning to auto-tune your axis.

The Online Command - Tune Servo dialog box opens. When the test completes, the Command Status changes from Executing to Command Complete.



8. Click OK.

The Tune Bandwidth dialog box opens.

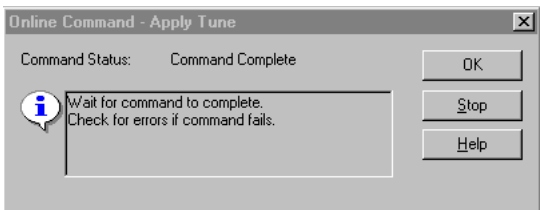


Actual bandwidth values (Hz) depend on your application and may require adjustment once motor and load are connected.

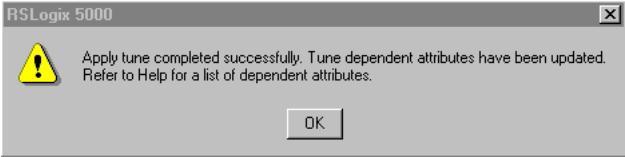
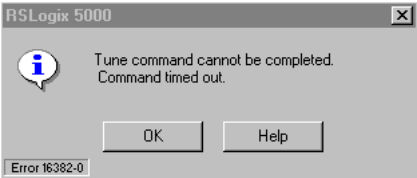
9. Record your bandwidth data for future reference.

10. Click OK.

The Online Command - Apply Tune dialog box opens. When the test completes, the Command Status changes from Executing to Command Complete.



- 11. Click OK.
- 12. Determine if your test completed successfully.

If	Then
Your test completes successfully, this dialog box opens. 	1. Click OK. 2. Remove the Hardware Enable Input signal (IOD-2) applied earlier. 3. Go to step 13.
Your test failed, this dialog box opens. 	1. Click OK. 2. Make an adjustment to motor velocity. 3. Refer to the appropriate Logix motion module user manual for more information. 4. Return to step 7 and run the test again.

- 13. Repeat Test and Tune the Axes for each axis.

Configure Drive Parameters and System Variables

This section provides information for accessing and changing parameters not accessible through RSLogix 5000 software.

Tools for Changing Parameters

Most parameters are accessible through RSLogix 5000 software. Alternatives include the DPI compatible Human Interface Module (HIM) and DriveExplorer software.

Table 80 - Software For Changing Parameters

Method	Description	Cat. No.	Firmware Revision
DriveExplorer	DriveExplorer software ⁽¹⁾	9306-4EXP02ENE	2.01 or later
	Serial to SCANport adapter	1203-SSS (Series B)	3.004 or later
HIM	Full numeric LCD HIM	20-HIM-A3 ⁽²⁾	N/A

(1) Refer to DriveExplorer Getting Results Manual, publication [9306-GR001](#), for instructions.

(2) Compatible catalog numbers include all 20-HIM-Ax.

Change Parameters with DriveExplorer Software

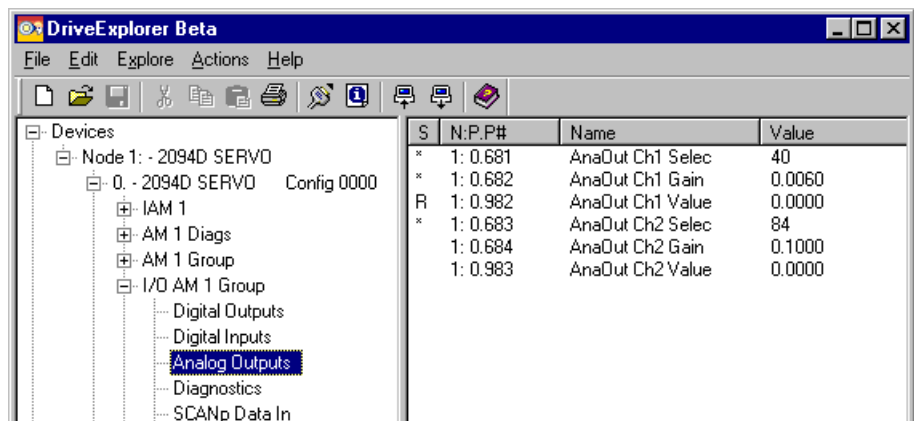
To navigate with DriveExplorer soft, refer to the example dialog box below. In this example, the I/O Interface group folder is open, the Analog Outputs parameter is selected, and the parameter elements are displayed in the box to the right.

IMPORTANT

Parameters are read-only when the SERCOS ring is active. You must break the SERCOS ring to change parameters.

To save changes, perform a non-volatile save (NVS) prior to cycling power.

Figure 79 - DriveExplorer Software Example



Change Parameters with the HIM Module

When using the HIM module to monitor or change parameters, use the up and down arrows (^ and v) to arrive at selections. Refer to the instructions that came with your HIM module for more information.

Follow these steps to monitor or change parameters with the HIM module.

- 1. Select parameter, press ↵.
- 2. Select I/O AM1 Group (for IAM module), press ↵.
- 3. Select Analog Outputs, press ↵.
 - a. Analog Output 1 is displayed, press ↵.
 - b. For Analog Output 2 use arrows to select, press ↵.
- 4. Press Sel.
- 5. Enter parameter number, press ↵.

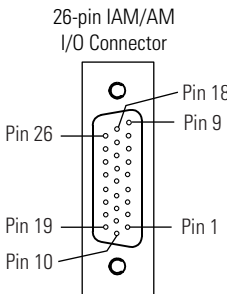
Monitor System Variables with Analog Test Points

There are two analog output test points accessible from the IOD 26-pin connector on the IAM and AM module.

Table 81 - IAM/AM I/O 26-pin (IOD) Connector

IOD Pin	Description	Signal
23	Analog output 0	DAC0
24	Analog output common	DAC_COM
25	Analog output 1	DAC1
26	Analog output common	DAC_COM

Figure 80 - Pin Orientation for 26-pin I/O (IOD) Connector



Refer to Analog Outputs on [page 65](#) for signal specifications.

Parameters begin with a variable to identify a specific axis by slot number, as follows:

- IAM module = 0 for parameters 0...999
- 1st AM module = 1 for parameters 1000...1999
- 2nd AM module = 2 for parameters 2000...2999 and so on
- 7th AM module = 7 for parameter 7000...7999

Table 82 - Monitor System Variables

Analog Output	Controlling Parameter		Scale Parameter	
	Parameter Number ⁽¹⁾	Default Value ⁽¹⁾	Parameter Number ⁽¹⁾	Default Value
1	x681	xx40	x682	0.0060
2	x683	xx84	x684	0.1000

(1) x = slot number

The value entered in Scale Parameter will scale the analog output so that you can get a full scale reading of the specific parameter for the dynamic range or values you are testing.

For linear scaling specifications, refer to the table on [page 65](#).

Table 83 - Monitor Dynamic System Variables

Attribute	Parameter Number ⁽¹⁾
Velocity feedback	xx40
Velocity commanded	xx36
Torque feedback	xx84
Torque commanded	xx80

(1) x = slot number.

Notes:

Troubleshooting the Kinetix 6000 Drive System

Introduction

This chapter provides troubleshooting tables for your Kinetix 6000 system components.

Topic	Page
Introduction	157
Safety Precautions	157
Interpret Status Indicators	158
General System Anomalies	167
Logix/Drive Fault Behavior	169

Safety Precautions

Observe these safety precautions when troubleshooting your Kinetix 6000 drive.



ATTENTION: Capacitors on the DC bus may retain hazardous voltages after input power has been removed. Before working on the drive, measure the DC bus voltage to verify it has reached a safe level or wait the full time interval as indicated in the warning on the front of the drive. Failure to observe this precaution could result in severe bodily injury or loss of life.



ATTENTION: Do not attempt to defeat or override the drive fault circuits. You must determine the cause of a fault and correct it before you attempt to operate the system. Failure to correct the fault could result in personal injury and/or damage to equipment as a result of uncontrolled machine operation.



ATTENTION: Provide an earth ground for test equipment (oscilloscope) used in troubleshooting. Failure to ground the test equipment could result in personal injury.

Interpret Status Indicators

Refer to these troubleshooting tables to identify faults, potential causes, and the appropriate actions to resolve the fault. If the fault persists after attempting to troubleshoot the system, please contact your Rockwell Automation sales representative for further assistance.

Error Codes

The following list of problematic symptoms (no error code shown) and faults with assigned error codes is designed to help you resolve anomalies.

When a fault is detected, the seven-segment status indicator will display an E followed by the flashing of the two-digit error code, one digit at a time. This is repeated until the error code is cleared.

Table 84 - Seven-segment Status Indicator Error Codes

Error Code	Fault Message RSLogix (HIM)	Anomaly or Symptom	Potential Cause	Possible Resolution
No Error Code Displayed		Power (PWR) indicator not ON	No AC power or auxiliary logic power.	Verify AC control power is applied to the Kinetix 6000 system.
			Internal power supply malfunction.	Call your Rockwell Automation sales representative to return module for repair.
		Motor jumps when first enabled	Motor wiring error.	- Check motor wiring. - Run Hookup test in RSLogix 5000 software.
			Incorrect motor chosen.	Verify the proper motor is selected.
		Digital I/O not working correctly	I/O power supply disconnected.	Verify connections and I/O power source.
E00	BusUndervoltage Fault (Blown fuse)	A blown fuse was detected on the inverter PCB	Blown fuse.	Call your Rockwell Automation sales representative to return module for repair.
E04	MotorOvertemp Fault (Motor Overtemp)	Motor thermal switch tripped	- High motor ambient temperature and/or - Excessive current	- Operate within (not above) the continuous torque rating for the ambient temperature 40 °C (104 °F) maximum. - Lower ambient temperature, increase motor cooling.
			Motor wiring error.	Check motor wiring at MF connector on the IAM/AM module.
			Incorrect motor selection.	Verify the proper motor has been selected.

Table 84 - Seven-segment Status Indicator Error Codes (Continued)

Error Code	Fault Message RSLogix (HIM)	Anomaly or Symptom	Potential Cause	Possible Resolution
E05	DriveOvercurrent Fault (Power Fault)	Self-protection of the Intelligent Power Module (IPM) is indicating a major power related fault condition.	Motor cables shorted.	Verify continuity of motor power cable and connector.
			Motor winding shorted internally.	Disconnect motor power cables from the motor. If the motor is difficult to turn by hand, it may need to be replaced.
			Kinetix 6000 drive temperature too high.	- Check for clogged vents or defective fan. - Make sure cooling is not restricted by insufficient space around the unit.
			Operation above continuous power rating and/or product environmental ratings.	- Verify ambient temperature is not too high. - Operate within the continuous power rating. - Reduce acceleration rates.
			Kinetix 6000 drive has a short circuit, overcurrent, or failed component.	Remove all power and motor connections, and perform a continuity check from the DC bus to the U, V, and W motor outputs. If a continuity exists, check for wire fibers between terminals, or send drive in for repair.
E06	HardOvertravel Fault (+/- Hard Overtravel)	Axis moved beyond the physical travel limits in the positive/negative direction.	Dedicated overtravel input is inactive.	- Check wiring. - Verify motion profile. - Verify axis configuration in software.
E07	MotFeedbackFault (Motor Feedback Loss)	The feedback wiring is open, shorted, or missing.		- Check motor encoder wiring. - Run Hookup test in RSLogix 5000 software.
E09	BusUndervoltage Fault (Bus Undervoltage)	With three-phase power present, the DC bus voltage is below limits.	- DC bus voltage for 460V system is below 275V - DC bus voltage for 230V system is below 137V	- Verify voltage level of the incoming AC power. - Check AC power source for glitches or line drop. - Install an uninterruptible power supply (UPS) on your AC input.
		DC bus voltage fell below the undervoltage limit while an axis on the follower power rail was enabled.		Disable follower axis before removing power.
E10	DriveOvervoltage Fault (Bus Overvoltage)	The DC bus voltage is above limits.	Excessive regeneration of power. When the motor is driven by an external mechanical power source, it may regenerate too much peak energy through the drive power supply. The system faults to save itself from an overload.	- Change the deceleration or motion profile. - Use a larger system (motor and Kinetix 6000 drive). - Install shunt module.
			- DC bus voltage for 460V system is over 820V - DC bus voltage for 230V system is over 410V	Verify input is within specifications.
E11	MotFeedbackFault (Illegal Hall State)	State of Hall feedback inputs is incorrect.	Improper connections.	- Verify the Hall wiring at the MF connector on the IAM/AM module. - Verify 5V power supply to the encoder.

Table 84 - Seven-segment Status Indicator Error Codes (Continued)

Error Code	Fault Message RSLogix (HIM)	Anomaly or Symptom	Potential Cause	Possible Resolution
E16	Softovertravel Fault (+/- Software Overtravel)	Axis position exceeded maximum software setting.		- Verify motion profile. - Verify overtravel settings are appropriate.
E18	OverSpeedFault (Overspeed Fault)	Motor speed has exceeded 150% of maximum rated speed. The 100% trip point is dictated by the lesser of the user velocity limits or the motor rated base speed.		- Check cables for noise. - Check tuning.
E19	PositionErrorFault (Follow Error)	Position error limit was exceeded.		- Increase the feed forward gain. - Increase following error limit or time. - Check position loop tuning. - Verify sizing of system. - Verify mechanical integrity of system within specification limits.
E20	MotFeedbackFault (Mtr Fdbk AQB)	Motor Encoder State Error	The motor encoder encountered an illegal transition.	- Use shielded cables with twisted pair wires. - Route the feedback away from potential noise sources. - Check the system grounds. - Replace the motor/encoder.
E21	AuxFeedbackFault (Aux Feedback Comm)	Communication was not established with an intelligent encoder.		Verify auxiliary encoder wiring.
E30	MotFeedbackFault (Motor Feedback Comm)	Communication was not established with an intelligent encoder.		- Verify motor selection. - Verify the motor supports automatic identification. - Verify motor encoder wiring.
E34	GroundShortFault (Ground Fault)	Excessive ground current in the converter was detected.	Wiring error.	- Check motor power wiring. - Check input power wiring.
			Motor internal ground short.	Replace motor.
			Internal malfunction.	Disconnect motor power cable from drive and enable drive with current limit set to 0. If fault clears, then a wiring error or motor internal anomaly exists. If fault remains, call your sales representative.
			Grounded control power terminal (applies to 230V systems only)	- Remove ground from control power input. - Source control power from three-phase input power (refer to page 204). - Add isolation transformer for control power.
E35	DriveUndervoltage Fault (Pre-charge Fault)	Converter pre-charge cycle failed.	Low AC input voltage.	Check input AC voltage on all phases.
			Internal malfunction.	Call your sales representative.
E36	DriveOvertemp Fault (System Overtemperature)	Converter thermal switch tripped.	Excessive heat exists in the power circuitry.	- Reduce acceleration rates. - Reduce duty cycle (ON/OFF) of commanded motion. - Increase time permitted for motion. - Use larger IAM converter module. - Check for clogged vents or defective fan. - Make sure cooling is not restricted by insufficient space around the unit.

Table 84 - Seven-segment Status Indicator Error Codes (Continued)

Error Code	Fault Message RSLogix (HIM)	Anomaly or Symptom	Potential Cause	Possible Resolution
E37	PowerPhaseLoss Fault (Phase Loss Flt)	- One or more phases of the input AC power is missing. - Axis was enabled when main (three-phase) power was removed. - common-bus follower axis was enabled when DC bus power was removed.		- Check input AC voltage on all phases. - Disable axis before removing power.
E38	SERCOSFault (SERCOS Ring Flt)	The SERCOS ring is not active after being active and operational.	Cable disconnected.	Check that fiber-optic cable is present and connected properly.
E39	DriveHardFault (Self Sense Flt)	Self-sensing Commutation Start-up Error	Motion required for self-sensing start-up commutation was obstructed.	- Verify that there are no impediments to motion at startup, such as hard limits. - Increase self-sensing current if high friction or load conditions exist. - Check motor or encoder wiring by using wiring diagnostics.
E43	DriveEnableInput Fault (Drive Enable Flt)	Missing Drive Enable Input Signal	- An attempt was made to enable the axis through software while the Drive Enable hardware input was inactive. - The Drive Enable input transitioned from active to inactive while the axis was enabled.	- Disable the Drive Enable Input fault. - Verify that Drive Enable hardware input is active whenever the drive is enabled through software.
E49	DriveHardFault (Safe-off HW Flt)	Safe-off function mismatch. Drive will not allow motion.	- Loose wiring at SO connector. - Cable/header not seated properly in SO connector. - Safe-off circuit missing +24V DC.	- Verify wire terminations, cable/header connections, and +24V. - Reset error and run proof test. - If error persists, return the drive to Rockwell Automation.
E50	SERCOSFault (SERCOS Same ADDR)	Duplicate node address detected on SERCOS ring.		Verify that each SERCOS drive is assigned a unique node address.
E54	DriveHardFault (Ifbk HW Fault)	Current feedback hardware fault detected.		Replace the module
E60	DriveHardFault (Unknown Axis)	Illegal ID bits detected		Replace the module
E61	AuxFeedbackFault (Aux Fdbk AQB)	Auxiliary Encoder State Error	The auxiliary encoder encountered an illegal transition.	- Use shielded cables with twisted pair wires. - Route the feedback away from potential noise sources. - Check the system grounds. - Replace the motor/encoder.
E62	AuxFeedbackFault (Aux Fdbk Loss)	The feedback wiring is open, shorted, or missing.		Check the motor feedback cable connectors/wiring to the IAM/AM module and servo motor.
E63	AuxFeedbackNoise (Aux Fdbk Noise)	Noise on auxiliary feedback cable.	Recommended grounding, per installation instructions, has not been followed.	- Verify grounding. - Route feedback cable away from noise sources. - Refer to System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001.
E64	MotorFeedbackNoise (Mtr Fdbk Noise)	Noise on motor feedback cable.		
E65	No Fault Message (condition indicated by on-screen message) (Hookup Fault)	Hookup procedure failed	Motor or feedback device malfunction.	- Check motor power/feedback wiring. - Refer to on-screen message for resolution.

Table 84 - Seven-segment Status Indicator Error Codes (Continued)

Error Code	Fault Message RSLogix (HIM)	Anomaly or Symptom	Potential Cause	Possible Resolution
E66	No Fault Message (condition indicated by on-screen message) (Atune Flt)	Autotune procedure failed	Motor or feedback device malfunction.	- Check motor power/feedback wiring. - Refer to on-screen message for resolution. - Perform Hookup in RSLogix 5000 software. - Consult RSLogix 5000 help screen.
E67	DriveHardFault (Task init)	Operating system failed	Software initialization fault detected due to hardware failure.	- Cycle power. - If fault persists, replace module.
E68	DriveHardFault (SCANport Comm)	DPI communication failed	The DPI device or cable is faulty.	Check DPI connections.
E69	DriveHardFault (Objects Init)	Non-volatile memory is corrupt due to control board hardware failure.		Load default parameters, save to non-volatile memory, and recycle power or reset the drive.
E70	DriveHardFault (NV Mem Init)	Non-volatile memory is corrupt due to control board software error.		Load default parameters, save to non-volatile memory, and recycle power or reset the drive.
E71	DriveHardFault (Memory Init)	RAM or Flash memory validation failure		- Cycle power. - If fault persists, replace module.
E72	DriveOvertemp Fault (Drive Overtemp)	Inverter thermal switch tripped	The IAM or an AM module fan failed.	Replace the failed module.
			The cabinet ambient temperature is above rating.	Check the cabinet temperature.
			The machine duty cycle requires an RMS current exceeding the continuous rating of the controller.	Change the command profile to reduce speed or increase time.
			The airflow access to the Kinetix 6000 system is limited or blocked.	Check airflow and re-route cables away from the Kinetix 6000 system.
E73	Communicate (Backplane Comm)	Power rail CAN communication failed.		Check module for proper mount.
		Power rail connection shorted or open.		Check power rail and module for foreign objects.
E74	DriveOvercurrent Fault (Bus OverCurrent)	DC link current exceeds rating.	Motor or transmission malfunction.	- Check for proper motor sizing. - Check/replace transmission device. - Check/replace motor.
			IAM module not sized properly.	- Check for proper IAM module sizing. - Install larger kW rated IAM module.
E75	DriveOvervoltage Fault (Shunt Time Out)	The IAM/AM module, or shunt module has exceeded its shunt resistor continuous rating.		- Use a properly sized shunt or modify duty cycle of the application. - System uses internal shunt and requires external shunt for additional capacity.
E76	DriveHardFault (CAN Init)	DPI hardware initialization fault detected.	Control board hardware failure.	- Reset System. - If fault persists, replace system module.
E77	DriveHardFault (Module Mismatch)	Either 230V AM module is installed on power rail with 460V IAM module, or 460V AM module is installed on power rail with 230V IAM module.		Replace mismatched module.
E78	DriveHardFault (SERCOS Init)	Control hardware fault detected.		- Cycle power. - If fault persists, replace module.

Table 84 - Seven-segment Status Indicator Error Codes (Continued)

Error Code	Fault Message RSLogix (HIM)	Anomaly or Symptom	Potential Cause	Possible Resolution
E79	DriveOvervoltage Fault (Shunt Module Flt)	Over-temperature fault indicator on Bulletin 2094 shunt module is steady red.		Refer to Temperature Fault Status Indicator on page 166 .
		Shunt-fault indicator on Bulletin 2094 shunt module is steady red.		Refer to Shunt Fault Status Indicator on page 166 .
		Bulletin 2094 shunt module is missing from power rail.		• Install missing module on power rail. • Fill empty slot with slot-filler module.
E80	DriveHardFault (CPLD Flt)	Control hardware fault detected.		Replace module.
E81	DriveHardFault (Common Bus Flt)	Follower IAM module detected AC input power being applied.		Remove AC input power connections from follower IAM module.
E90	DriveHardFault (Pre-charge Timeout Flt)	Pre-charge resistor power exceeds the resistor rating.		Wait for resistor to cool.

IAM/AM Module Status Indicators

Table 85 - Drive Status Indicator

Drive Status Indicator	Drive Status	Possible Resolution
Off	Normal, no faults	N/A
Steady red	Drive faulted	Refer to seven-segment error code and Error Codes troubleshooting on page 158 .

Table 86 - Comm Status Indicator

Comm Status Indicator	Drive Status	Potential Cause	Possible Resolution
Off	No communication ⁽¹⁾	Loose fiber-optic connection.	Verify proper fiber-optic cable connections.
		Broken fiber-optic cable.	Replace fiber-optic cable.
		Receive fiber-optic cable connected to SERCOS transmit connector and vice versa.	Check proper SERCOS fiber-optic cable connections.
Flashing green	Establishing communication	System is still in the process of establishing SERCOS communication.	Wait for steady green indicator.
		Node address setting on the drive module does not match SERCOS controller configuration.	Verify proper node switch setting.
Steady green	Communication ready	No faults or failures.	N/A

(1) Refer to Fiber-optic Cable Installation and Handling Instructions, publication [2090-IN010](#), for more information.

Table 87 - Bus Status Indicator

Bus Status Indicator	Bus Status	Condition
Off	No power or DC bus is not present.	- Normal when bus power is not applied. - Fault exists, refer to seven-segment error code and Error Codes troubleshooting on page 158.
	Bus power is present in follower IAM.	- Follower IAM module is not configured as CommonBus Follow in RSLogix 5000 software. - After DC bus voltage is applied, a 2.5 second delay before the indicator begins flashing green is normal operation to provide the common-bus leader module time to complete pre-charge.
Flashing green	Bus power is present, axis disabled. No faults.	Normal when: 24V is not applied to Hardware Enable Input (IOD-2). - MSO instruction is not commanded in RSLogix 5000 software.
Steady green	Bus power is present, axis enabled. No faults.	Normal when: 24V is applied to Hardware Enable Input (IOD-2). - MSO instruction is commanded in RSLogix 5000 software.

Shunt Module Status Indicators

Each of the shunt module status indicators provide specific troubleshooting information.

Table 88 - General Shunt Module Troubleshooting

Module	Status	Under These Conditions
Shunt	Fault is latched.	Until fault condition is corrected and cleared.
	Fault is cleared.	- Using MASR, MAFR, MGSR instructions or the HIM (red stop button). - Only after the DC bus is discharged (bus status indicator is flashing). - Drive must be configured with 2094-BSP2 shunt module or Bulletin 1394 external shunt module.
IAM/AM	Disabled (for DC bus regulation).	- When the 2094-BSP2 shunt module is used on a 230V system. - When either 230V or 460V system is configured with a Bulletin 1394 external shunt module. - When configured in Common-bus Follower mode.
	Enabled to discharge the DC bus.	Drive (IAM or leader IAM module) three-phase power is removed.
	Disabled from discharging the DC bus.	When configured in Common-bus Follower mode.

IMPORTANT Under some fault conditions, two reset commands may be required to clear drive and shunt module faults.

Table 89 - Bus Status Indicator

Bus Status Indicator	Status	Potential Cause	Possible Resolution
Flashing	Normal condition when control power is applied and bus voltage is less than 60V DC.		N/A
Steady Green	Normal condition when control power is applied and bus voltage is greater than 60V DC.		N/A
Off	Control power is not present.	Internal power supply failure.	Replace shunt module.

Table 90 - Temperature Fault Status Indicator

Over-Temp Fault Indicator	Status	Potential Cause	Possible Resolution
Off	Normal condition.		N/A
Steady Red	Shunt module internal temperature exceeds operating temperature specification.	Shunt module fan failed.	Replace shunt module.
		Shunt module temperature exceeds rating.	- Wait for shunt module to cool. - Reset faults. - Verify IAM module bus regulator configuration.
	External over temperature condition.	External temperature switch is open.	- Wait for shunt module to cool. - Reset faults. - Verify IAM module bus regulator configuration.
		TS jumper is not present.	Install jumper.

Table 91 - Shunt Fault Status Indicator

Shunt Fault Indicator	Status	Potential Cause	Possible Resolution
Off	Normal condition		N/A
Steady Red	Shorted internal or external shunt resistor.	Mis-wired shunt jumper or other short on RC connector.	- Correct mis-wire (shorted) condition. - If anomaly persists, replace shunt module.
		Mis-wired (shorted) external shunt wiring.	

Table 92 - All Shunt Module Status Indicators

Shunt Module Status Indicator	Status	Potential Cause	Possible Resolution
- Bus Status - Over-Temp Fault - Shunt Fault	All three status indicators flash simultaneously.	Shunt module hardware failure.	- Cycle power. - If anomaly persists, replace shunt module.

General System Anomalies

These anomalies do not always result in a fault code, but may require troubleshooting to improve performance.

Table 93 - General System Anomalies

Condition	Potential Cause	Possible Resolution
Axis or system is unstable.	The position feedback device is incorrect or open.	Check wiring.
	Unintentionally in Torque mode.	Check to see what primary operation mode was programmed.
	Motor tuning limits are set too high.	Run Tune in RSLogix 5000 software.
	Position loop gain or position controller accel/decel rate is improperly set.	Run Tune in RSLogix 5000 software.
	Improper grounding or shielding techniques are causing noise to be transmitted into the position feedback or velocity command lines, causing erratic axis movement.	Check wiring and ground.
	Motor Select limit is incorrectly set (servo motor is not matched to axis module).	- Check setups. - Run Tune in RSLogix 5000 software.
	Mechanical resonance.	Notch filter or output filter may be required (refer to Axis Properties dialog box, Output tab in RSLogix 5000 software).
You cannot obtain the motor acceleration/deceleration that you want.	Torque Limit limits are set too low.	Verify that current limits are set properly.
	Incorrect motor selected in configuration.	Select the correct motor and run Tune in RSLogix 5000 software again.
	The system inertia is excessive.	- Check motor size versus application need. - Review servo system sizing.
	The system friction torque is excessive.	Check motor size versus application need.
	Available current is insufficient to supply the correct accel/decel rate.	- Check motor size versus application need. - Review servo system sizing.
	Acceleration limit is incorrect.	Verify limit settings and correct them, as necessary.
	Velocity Limit limits are incorrect.	Verify limit settings and correct them, as necessary.
Motor does not respond to a velocity command.	The axis cannot be enabled for 1.5 seconds after disabling.	Disable the axis, wait for 1.5 seconds, and enable the axis.
	Enable signal has not been applied or the enable wiring is incorrect.	- Check the controller. - Check the wiring.
	The motor wiring is open.	Check the wiring.
	The motor thermal switch has tripped.	- Check for a fault. - Check the wiring.
	The motor has malfunctioned.	Repair or replace the motor.
	The coupling between motor and machine has broken (for example, the motor moves, but the load/machine does not).	Check and correct the mechanics.
	Primary operation mode is set incorrectly.	Check and properly set the limit.
	Velocity or current limits are set incorrectly.	Check and properly set the limits.

Table 93 - General System Anomalies (Continued)

Condition	Potential Cause	Possible Resolution
Presence of noise on command or motor feedback signal wires.	Recommended grounding per installation instructions have not been followed.	• Verify grounding. • Route wire away from noise sources. • Refer to System Design for Control of Electrical Noise, publication GMC-RM001.
	Line frequency may be present.	• Verify grounding. • Route wire away from noise sources.
	Variable frequency may be velocity feedback ripple or a disturbance caused by gear teeth or ballscrew balls, for example. The frequency may be a multiple of the motor power transmission components or ballscrew speeds resulting in velocity disturbance.	• Decouple the motor for verification. • Check and improve mechanical performance, for example, the gearbox or ballscrew mechanism.
No rotation	The motor connections are loose or open.	Check motor wiring and connections.
	Foreign matter is lodged in the motor.	Remove foreign matter.
	The motor load is excessive.	Verify the servo system sizing.
	The bearings are worn.	Return the motor for repair.
	The motor brake is engaged (if supplied).	• Check brake wiring and function. • Return the motor for repair.
	The motor is not connect to the load.	Check coupling.
Motor overheating	The duty cycle is excessive.	Change the command profile to reduce accel/decel or increase time.
	The rotor is partially demagnetized causing excessive motor current.	Return the motor for repair.
Abnormal noise	Motor tuning limits are set too high.	Run Tune in RSLogix 5000 software.
	Loose parts are present in the motor.	• Remove the loose parts. • Return motor for repair. • Replace motor.
	Through bolts or coupling is loose.	Tighten bolts.
	The bearings are worn.	Return motor for repair.
	Mechanical resonance.	Notch filter may be required (refer to Axis Properties dialog box, Output tab in RSLogix 5000 software).
Erratic operation - Motor locks into position, runs without control or with reduced torque.	Motor power phases U and V, U and W, or V and W reversed.	Check and correct motor power wiring.
	Sine, Cosine or Rotor leads are reversed in the feedback cable connector.	Check and correct motor feedback wiring.
	Sine, Cosine, Rotor lead sets of resolver feedback are reversed.	Check and correct motor feedback wiring.

Logix/Drive Fault Behavior

These RSLogix 5000 fault actions are configurable from the Axis Properties dialog box, Fault Actions tab.

Table 94 - Drive Fault Action Definitions

Drive Fault Action	Definition
Shutdown	The drive disables and the contactor enable relay opens. Uncontrolled stop, motor coasts to a stop.
Disable Drive	The drive is disabled. Uncontrolled Stop, motor coasts to a stop.
Stop Motion	Logix configuration for velocity loop Kp/Ki is followed. When zero speed is reached or stopping time is exceeded, the drive is disabled. Stopping time and stopping torque are configurable parameters in RSLogix 5000 software.
Status Only	Drive continues to operate. Status is provided by the seven-segment Fault Status Indicator, drive status indicator, and DPI (if used).

Only selected faults are programmable. In the Logix/Drive Fault Behavior table on [page 170](#), the controlling attribute is given for programmable fault actions.

Figure 81 - RSLogix 5000 Axis Properties - Fault Actions Tab

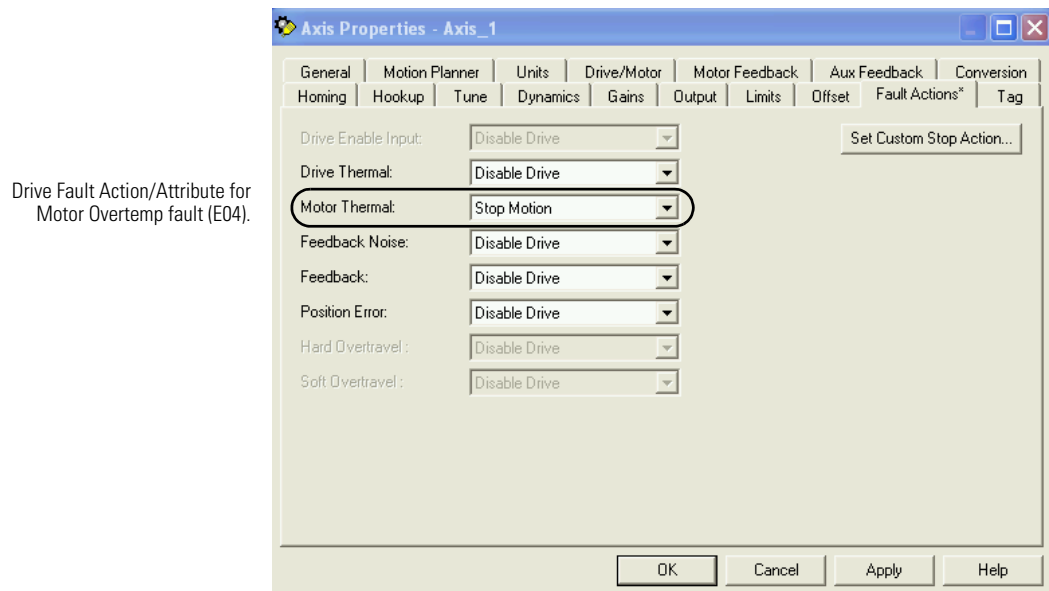


Table 95 - Logix/Drive Fault Behavior

Logix Fault Message (HIM Message)	Error Code	Description	Drive Fault Action/Attribute	RSLogix Programmable Fault Action?
BusUndervoltageFault (Blown fuse)	E00	A blown fuse was detected in the inverter pcb.	SHUTDOWN	No
MotorOvertempFault (Motor Overtemp)	E04 ⁽¹⁾	The motor thermal switch was tripped. Firmware I ² t protection does not generate a fault, rather it dynamically folds back current when 110% of motor rating is reached. Setting the Motor Thermal fault action to Status Only will bypass this function.	STOP MOTION Motor Thermal	Yes
DriveOvercurrentFault (Power Fault)	E05	An instantaneous over-current was detected in the inverter power section.	SHUTDOWN	No
HardOvertravelFault (+/- Hard Overtravel)	E06	Axis moved beyond the physical travel limits in the positive/negative direction. This fault can be configured for status only.	STOP MOTION Hard Overtravel	Yes
MotFeedbackFault (Motor Feedback Loss)	E07	The feedback wiring is open, shorted or missing.	DISABLE DRIVE	No
BusUndervoltageFault (Bus Under Voltage)	E09	With 3-phase present, the DC bus voltage is below limits. The trip point is 275V and 137V DC for 460V/230V drives respectively. DC bus voltage is below limits when any axis on common-bus follower power rail was enabled.	SHUTDOWN	No
DriveOvervoltageFault (Bus Overvoltage)	E10	The DC bus voltage is above limits. The trip point is 820V and 410V DC for 460V/230V drives respectively.	SHUTDOWN	No
MotFeedbackFault (Illegal Hall State)	E11	State of Hall feedback inputs is incorrect.	DISABLE DRIVE	No
SoftovertravelFault (+/- Software Overtravel)	E16	Axis position exceeded maximum software setting in the positive/negative direction. This fault can be configured for status only.	STOP MOTION Soft Overtravel	Yes
OverSpeedFault (Overspeed Fault)	E18	Axis speed has reached 150% of the maximum rated setting. The 100% trip point is dictated by the lesser of the user velocity limits or the motor rated base speed.	DISABLE DRIVE	No
PositionErrorFault (Follow Error)	E19	Axis position error limit has been exceeded. This fault can be configured for status only.	STOP MOTION Position Error	Yes
MotFeedbackFault (Mtr Fdbk AQB)	E20	Motor encoder has encountered an illegal state transition.	DISABLE DRIVE	No
AuxFeedbackFault (Aux Feedback Comm)	E21	Communication was not established with an intelligent (Stegmann) encoder on the Auxiliary feedback port.	STOP MOTION	No
MotFeedbackFault (Motor Feedback Comm)	E30	Communication was not established with an intelligent (Stegmann) encoder on the Motor feedback port.	STOP MOTION	No
GroundShortFault (Ground Fault)	E34	Excessive ground current in the converter was detected.	SHUTDOWN	No
DriveUndervoltageFault (Precharge Fault)	E35	The converter pre-charge cycle has failed.	SHUTDOWN	No
DriveOvertempFault (System Overtemperature)	E36 ⁽²⁾	Converter internal temperature limit exceeded.	SHUTDOWN	No

Table 95 - Logix/Drive Fault Behavior (Continued)

Logix Fault Message (HIM Message)	Error Code	Description	Drive Fault Action/Attribute	RSLogix Programmable Fault Action?
PowerPhaseLossFault (Phase Loss Flt)	E37	- One or more phases of the input AC power is missing. - Axis was enabled when main (three-phase) power was removed. - Common-bus follower axis was enabled when DC bus power was removed.	SHUTDOWN/STOP MOTION	No
SERCOSFault (SERCOS Ring Flt)	E38	The SERCOS ring is not active after being active and operational.	STOP MOTION	No
DriveHardFault (Self Sense Flt)	E39	Self-sensing commutation fault detected.	DISABLE DRIVE	No
DriveEnableInputFault (Drive Enable Flt)	E43	Generated when Enable input switches off when drive is enabled.	STOP MOTION Drive Enable Input	Yes
DriveHardFault (Safe-Off HW Flt)	E49	Safe-off function mismatch. Drive will not allow motion. Refer to the Kinetix Safe-off Feature Safety Reference Manual, publication GMC-RM002 , for more information. Applies to 2094-xCxx-Mxx-S IAM and 2094-xMxx-S AM modules with safe-off feature.	SHUTDOWN	No
SERCOSFault (SERCOS Same ADDR)	E50	Duplicate node address detected on SERCOS ring.	STOP MOTION	No
DriveHardFault (Ifbk HW Fault)	E54	Current feedback hardware fault detected.	SHUTDOWN	No
DriveHardFault (Unknown Axis)	E60	Invalid module type identified by firmware when applying power.	SHUTDOWN	No
AuxFeedbackFault (Aux Fdbk AQB)	E61	Auxiliary encoder has encountered an illegal state transition.	DISABLE DRIVE	No
AuxFeedbackFault (Aux Fdbk Loss)	E62	The feedback wiring is open, shorted or missing.	DISABLE DRIVE	No
AuxFeedbackNoise (Aux Fdbk Noise)	E63	Presence of noise on auxiliary feedback cable.	DISABLE DRIVE Feedback Noise	Yes
MotorFeedbackNoise (Mtr Fdbk Noise)	E64	Presence of noise on motor feedback cable.		
No Fault Message (condition indicated by on-screen message) (Hookup Fault)	E65	Hookup procedure failed.	DISABLE DRIVE	No
No Fault Message (condition indicated by on-screen message) (Atune Flt)	E66	Autotune procedure failed.	DISABLE DRIVE	No
DriveHardFault (Task init)	E67	Operating system failed.	SHUTDOWN	No
DriveHardFault (SCANport Comm)	E68	DPI communication failed.	STOP MOTION	No
DriveHardFault (Objects Init)	E69	Non-volatile memory attribute out of range.	SHUTDOWN	No
DriveHardFault (NV Mem Init)	E70	Non-volatile memory corrupted.	SHUTDOWN	No

Table 95 - Logix/Drive Fault Behavior (Continued)

Logix Fault Message (HIM Message)	Error Code	Description	Drive Fault Action/Attribute	RSLogix Programmable Fault Action?
DriveHardFault (Memory Init)	E71	RAM or flash memory validation failure.	SHUTDOWN	No
DriveOvertempFault (Drive Overtemp)	E72	Inverter temperature limit exceeded. Firmware I ² t protection does not generate a fault, rather it dynamically folds back current when 110% of drive rating is reached.	SHUTDOWN Drive Thermal	Yes
Communicate (Backplane Comm)	E73	Power rail backplane CAN communication failed.	STOP MOTION	No
DriveOvercurrentFault (Bus OverCurrent)	E74	The converter has exceeded its converter rating.	SHUTDOWN	No
DriveOvervoltageFault (Shunt Time Out)	E75	The IAM/AM module or shunt module has exceeded its shunt resistor continuous rating. SHUTDOWN for IAM module, DISABLE for AM module. IAM module provides fault handling for shunt module.	SHUTDOWN	No
DriveHardFault (Can Init)	E76	Either DPI or backplane CAN initialization failure.	SHUTDOWN	No
DriveHardFault (Module Mismatch)	E77	Generated by IAM module if the power rating of an AM module on the same power rail does not match with IAM module input power rating.	SHUTDOWN	No
DriveHardFault SERCOS Init	E78	Control hardware fault detected.	SHUTDOWN	No
DriveOvervoltageFault (Shunt Module Flt)	E79	Power rail mounted shunt module fault. Displayed on IAM module seven-segment fault status indicator.	SHUTDOWN	No
HardwareFault (CPLD Flt)	E80	Control hardware fault detected.	SHUTDOWN	No
HardwareFault (Common Bus Flt)	E81	Common-bus follower IAM module detected AC input power being applied.	SHUTDOWN	No
HardwareFault (Pre-charge Timeout Flt)	E90	Pre-charge resistor power exceeds the resistor rating.	SHUTDOWN	No

- (1) The Logix Motor Thermal Fault Action is tied to the motor thermostat fault. If this is set to Shutdown or Disable (in Logix), the drive will fold back the current when the I²T calculation indicates that the motor temperature has exceeded 10% of its rated temperature. If it is set to Stop Motion or Status Only, the drive will not fold back the current. The I²T calculation never generates a fault.
- (2) The Logix Drive Thermal Fault Action is tied to the drive thermostat fault. The drive will always fold back the current when the I²T calculation indicates that the drive has exceeded 110% of its rating. The I²T calculation never generates a fault.

Removing and Replacing the Kinetix 6000 Drive Modules

Introduction

This chapter provides remove and replace procedures for your Kinetix 6000 system components.

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ATTENTION: This drive contains electrostatic discharge (ESD) sensitive parts and assemblies. You are required to follow static-control precautions when you install, test, service, or repair this assembly. If you do not follow ESD control procedures, components can be damaged. If you are not familiar with static control procedures, refer to Guarding Against Electrostatic Damage, publication [8000-4.5.2](#), or any other applicable ESD awareness handbook.

Before You Begin

You will need these tools available before you begin removal and replacement procedures:

- A screwdriver
- A small screwdriver, 3.5 mm (0.14 in.)
- Voltmeter

Remove Kinetix 6000 Drive Modules

Follow these steps to remove drive modules, from the Bulletin 2094 power rail.

1. Verify that all control and input power has been removed from the system.



ATTENTION: To avoid shock hazard or personal injury, assure that all power has been removed before proceeding. This system may have multiple sources of power. More than one disconnect switch may be required to de-energize the system.

2. Wait five minutes for the DC bus to discharge completely before proceeding.

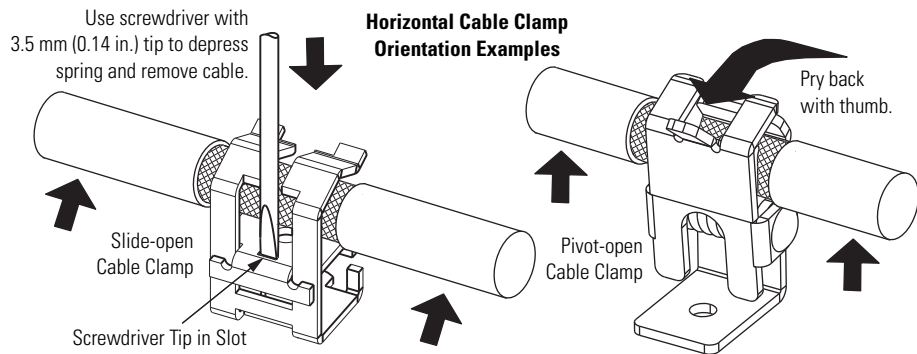
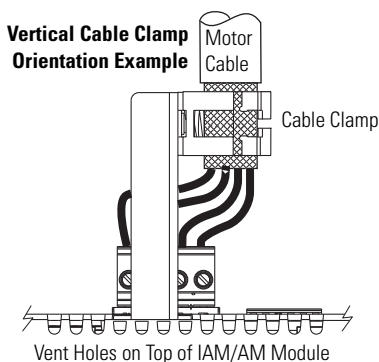


ATTENTION: This product contains stored energy devices. To avoid hazard of electrical shock, verify that all voltage on capacitors has been discharged before attempting to service, repair, or remove this unit. You should only attempt the procedures in this document if you are qualified to do so and are familiar with solid-state control equipment and the safety procedures in publication NFPA 70E.

3. Label and remove all connectors from the IAM/AM module you are removing.

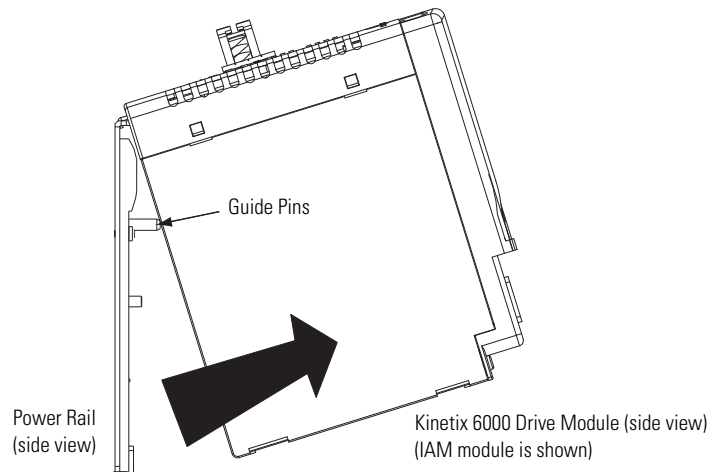
To identify each connector, refer to [page 54](#).

4. Remove the motor cable from the cable shield clamp, as shown in these examples.



5. Loosen the mounting screw (bottom center of each module).
6. Grasp top and bottom of the module with both hands and gently pull the module away from the connectors enough to clear the guide pins (module will pivot on top bracket).

7. Lift the bracket out of the power rail slot and remove the module from the power rail.



TIP This procedure also applies to Bulletin 2094-BSP2 shunt modules and 2094-PRF slot-filler modules.

Replace Kinetix 6000 Drive Modules

Follow these steps to replace drives from the Bulletin 2094 power rail.

Follow these steps to replace the drive modules.

1. Determine your drive module replacement.

If you are	Then
Replacing a drive module on an existing power rail	Go to step 3 .
Replacing a drive module on a new power rail	Go to step 2 .

2. Prepare to mount your replacement drive module by removing the protective boots from the power rail connector.
3. Hang the mounting bracket from the slot on the power rail.

IMPORTANT Power rails must be in vertical orientation before replacing drive modules or pins may not seat properly.

4. Align the guide pins on the power rail with the guide pin holes in the back of the drive module (refer to the figure above).

TIP The IAM module can have two or three power rail connectors and guide pins, the AM module can have one or two, all other modules have only one connector and one guide pin.

5. Use 2.26 N•m (20 lb•in) torque to tighten the mounting screw.
6. Reconnect the module connectors.

7. Reapply power to the system.

8. Verify that the system is operating properly.

TIP

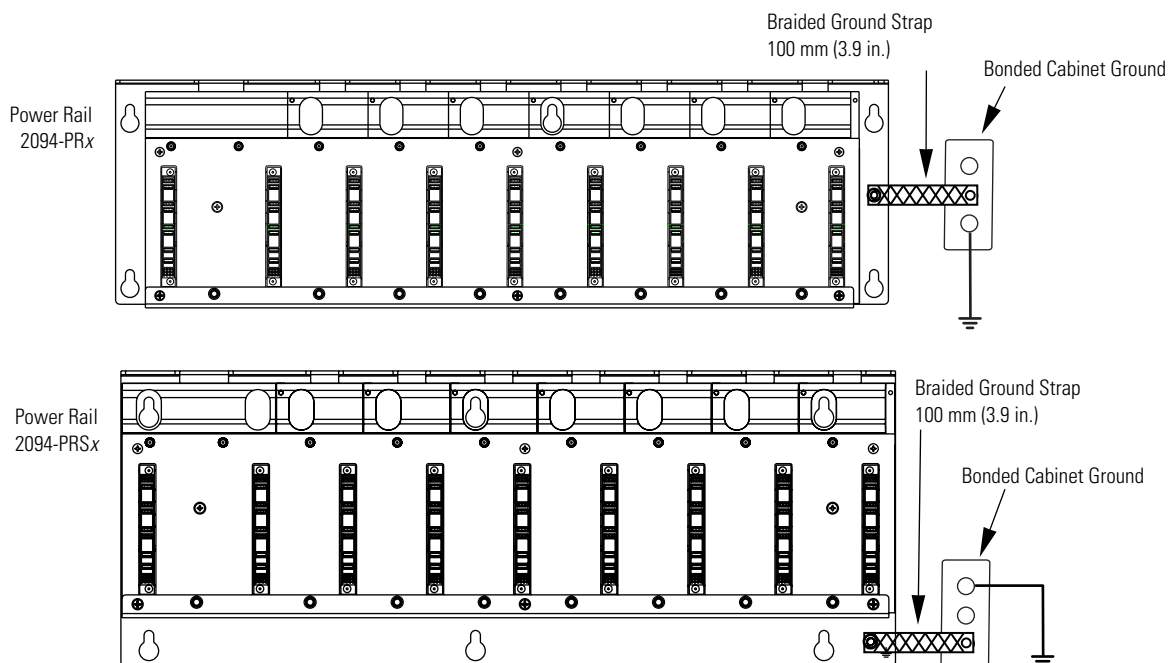
Because parameter settings reside in RSLogix 5000 software, you do not need to perform any tuning or set-up procedures.

Remove the Power Rail

This procedure assumes you have removed all modules from the power rail.

Follow these steps to remove the power rail.

1. Disconnect the braided grounding strap from the grounding stud located on the right side of the power rail.



2. Loosen the mounting bolts (removing the bolts is not necessary).
3. Lift the power rail up and off of the mounting bolts.

Replace the Power Rail

This procedure assumes you do not need to change the location of the power rail on the panel and you intend to reuse the mounting bolts of the power rail you just removed.

IMPORTANT If you need to change the location of the power rail, or if you are installing a power rail designed for additional or fewer modules than you removed, refer to Kinetix 6000 Power Rail Installation Instructions, publication [2094-IN003](#).



ATTENTION: To avoid damage to the power rail during installation, do not remove the protective boots until the module for each slot is ready for mounting.

Follow these steps to replace the power rail.

1. Align the replacement power rail over the existing mounting bolts.

IMPORTANT To improve the bond between the power rail and subpanel, construct your subpanel out of zinc plated (paint-free) steel.

2. Tighten the mounting bolts.
3. Reattach the braided grounding strap to the power rail grounding stud (refer to [page 176](#)).

Notes:

Specifications and Dimensions

Introduction

This appendix provides product specifications and mounting dimensions for your Kinetix 6000 system components.

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Power Specifications

This section contains power specifications for your Kinetix 6000 system components.

Integrated Axis Module (converter) Power Specifications

Table 96 - IAM Module (230V) Power Specifications

Attribute	2094-AC05-MP5-x	2094-AC05-M01-x	2094-AC09-M02-x	2094-AC16-M03-x	2094-AC32-M05-x
AC input voltage	195...264V rms three-phase (230V nom)				
AC input frequency	47...63 Hz				
Main AC input current Nom (rms) Max inrush (0-pk) ⁽¹⁾	10 A 19 A	19 A 37 A	36 A 73 A	71 A 138 A	
DC input voltage (common-bus follower)	275...375V DC				
DC input current (common-bus follower)	10 A	19 A	36 A	71 A	
Control power AC input voltage	95...264V rms single-phase (230V nom)				
Control power AC input current Nom (@ 220/230V AC) rms Nom (@ 110/115V AC) rms Max inrush (0-pk)	3 A 6 A 20 A		3 A 6 A 83 A ⁽²⁾		
Nominal bus output voltage	325V DC				
Line loss ride through	20 ms				
Continuous output current to bus (A_{dc})	10 A	19 A	36 A	71 A	
Peak output current to bus (A_{dc}) ⁽³⁾	20 A	38 A	72 A	142 A	
Bus overvoltage	415V DC				
Bus undervoltage	138V DC				
Internal shunt Continuous power Peak power	N/A N/A	50 W 8200 W	200 W 5700 W	200 W 5700 W	
Internal shunt resistor	N/A	20 Ω	28.75 Ω	28.75 Ω	
Shunt on	N/A	405V DC			
Shunt off	N/A	375V DC			
Continuous power output to bus	3 kW	6 kW	11.3 kW	22.5 kW	
Peak power output	6 kW	12 kW	22.6 kW	45.0 kW	
Efficiency	95%				
Converter inductance	N/A		150 μ H	75 μ H	
Converter capacitance	270 μ F	540 μ F	1320 μ F	1980 μ F	
Short circuit current rating	200,000 A (rms) symmetrical				

(1) All IAM modules are limited to 2 contactor cycles per minute (with up to 4 axes), or 1 contactor cycle per minute (with 5...8 axes). The cycle capability also depends on the converter power rating and the total system capacitance. Refer to Input Power Cycle Capability on [page 68](#), when making calculations.

(2) Maximum inrush duration is less than 1/2 line cycle.

(3) Peak output current duration equals 250 ms.

Table 97 - IAM Module (460V) Power Specifications (series A and B)

Attribute	2094-BC01-MP5-x	2094-BC01-M01-x	2094-BC02-M02-x	2094-BC04-M03-x	2094-BC07-M05-x
AC input voltage	324...528V rms three-phase (360...480V nom)				
AC input frequency	47...63 Hz				
Main AC input current Nom (rms) Max inrush (0-pk) ⁽¹⁾	10.0 A 11.0 A	24.0 A 22.0 A	44.0 A 31.1 A	71.0 A 62.2 A	
DC input voltage (common bus follower)	458...747V DC				
DC input current (common-bus follower)	9.0 A	22.6 A	41.5 A	67.7 A	
Control power AC input voltage	95...264V rms single-phase (110...240V rms nom)				
Control power AC input current Nom (@ 220/230V AC) rms Nom (@ 110/115V AC) rms Max inrush (0-pk)	3 A 6 A 98 A ⁽²⁾				
Nominal bus output voltage	650V DC				
Line loss ride through	20 ms				
Continuous output current to bus (A_{dc})	9.0 A	22.6 A	41.5 A	67.7 A	
Peak output current to bus (A_{dc}) Series A drives ⁽³⁾ Series B drives	18.1 A 22.6 A ⁽⁴⁾	45.2 A 56.4 A ⁽⁴⁾	83.1 A 103.8 A ⁽⁴⁾	135.4 A 203.2 A ⁽⁵⁾	
Bus overvoltage	825V DC				
Bus undervoltage	275V DC (when enabled) 425V DC (at the completion of pre-charge)				
Internal shunt Continuous power Peak power	50 W 5.6 kW		200 W 22.5 kW		
Internal shunt resistor	115 Ω		28.75 Ω		
Shunt on	805V DC				
Shunt off	755V DC				
Continuous power output to bus	6 kW	15 kW	27.6 kW	45 kW	
Peak power output at 480V Series A drives ⁽³⁾ Series B drives	12 kW 15 kW ⁽⁴⁾	30 kW 37 kW ⁽⁴⁾	55.2 kW 69 kW ⁽⁴⁾	90 kW 135 kW ⁽⁵⁾	
Efficiency	97%				
Converter inductance	500 μ H		125 μ H	75 μ H	
Converter capacitance	110 μ F	220 μ F	940 μ F	1410 μ F	
Short circuit current rating	200,000 A (rms) symmetrical				

(1) All IAM modules are limited to 2 contactor cycles per minute (with up to 4 axes), or 1 contactor cycle per minute (with 5...8 axes). The cycle capability also depends on the converter power rating and the total system capacitance. Refer to Input Power Cycle Capability on [page 68](#), when making calculations.

(2) For eight axis systems with 230V AC control input voltage and 50 °C (122 °F) ambient temperature the maximum inrush duration is less than 1/2 line cycle. To calculate the maximum inrush duration for other configurations, refer to Refer to Control Power on [page 72](#), when making calculations.

(3) Peak output current duration equals 250 ms.

(4) Converter peak output duration equals 400 ms with a duty cycle of 16%.

(5) Converter peak output duration equals 200 ms with a duty cycle of 3%.

Table 98 - Control Power Current Requirements

Modules on Power Rail	110/115V AC Input ⁽¹⁾ A	220/230V AC Input ⁽¹⁾ A	Input VA VA	Modules on Power Rail	110/115V AC Input ⁽¹⁾ A	220/230V AC Input ⁽¹⁾ A	Input VA VA
IAM only	0.75	0.35	150	IAM and 4 AM	3.75	1.70	450
IAM and 1 AM	1.50	0.70	200	IAM and 5 AM	4.50	2.0	550
IAM and 2 AM	2.25	1.0	275	IAM and 6 AM	5.25	2.40	650
IAM and 3 AM	3.0	1.35	350	IAM and 7 AM	6.0	3.0	750

(1) Refer to Control Power on [page 72](#) for more information.

Axis Module (inverter) Power Specifications

These tables list power specifications for the Kinetix 6000 AM modules. The specifications apply to the axis module specified in the column heading by catalog number and the same axis module (inverter section) that resides within an IAM module.

Table 99 - AM Module (inverter) 230V Power Specifications

Attribute	2094-AMP5- <i>x</i> (2094-AC05-MP5- <i>x</i>)	2094-AM01- <i>x</i> (2094-AC05-M01- <i>x</i>)	2094-AM02- <i>x</i> (2094-AC09-M02- <i>x</i>)	2094-AM03- <i>x</i> (2094-AC16-M03- <i>x</i>)	2094-AM05- <i>x</i> (2094-AC32-M05- <i>x</i>)
Bandwidth ⁽¹⁾ Velocity loop Current loop	500 Hz 1300 Hz				
PWM frequency	8 kHz		4 kHz		
Nominal input voltage	325V DC				
Continuous current (rms)	3.7 A	6.0 A	10.6 A	17.3 A	34.6 A
Continuous current (0-pk)	5.2 A	8.5 A	15.0 A	24.5 A	48.9 A
Peak current (rms) ⁽²⁾	7.4 A	12.0 A	21.2 A	34.6 A	51.9 A
Peak current (0-pk) ⁽²⁾	10.5 A	17.0 A	30.0 A	48.9 A	73.4 A
Continuous power out (nom)	1.2 kW	1.9 kW	3.4 kW	5.5 kW	11.0 kW
Internal shunt Continuous power Peak power	N/A N/A			50 W 1400 W	
Internal shunt resistor	N/A			115 Ω	
Shunt on	N/A			405V DC	
Shunt off	N/A			375V DC	
Efficiency	98%				
Capacitance	390 μF	660 μF	780 μF	1320 μF	2640 μF
Capacitive energy absorption	15 J	25 J	29 J	50 J	99 J
Short circuit current rating	200,000 A (rms) symmetrical				

(1) Bandwidth values vary based on tuning parameters and mechanical components.

(2) Peak current duration equals 2.5 seconds.

IMPORTANT The peak current ratings of the Kinetix 6000 AM modules (series A and B) are configured at the factory as 150% of continuous current. You can program 2094-BMP5-S, 2094-BM01-S, 2094-BM02-S, and 2094-BM03-S, series-B drives and their equivalent IAM (inverter) modules, for up to 250% of continuous inverter current. You can program 2094-BM05-S, series-B drives and 2094-BC07-M05 IAM (inverter) modules, for up to 200% of continuous inverter current.

Table 100 - AM Module (inverter) 460V Power Specifications (series A and B)

Attribute	2094-BMP5-x (2094-BC01-MP5-x)	2094-BM01-x (2094-BC01-M01-x)	2094-BM02-x (2094-BC02-M02-x)	2094-BM03-x (2094-BC04-M03-x)	2094-BM05-x (2094-BC07-M05-x)
Bandwidth ⁽¹⁾ Velocity loop Current loop	500 Hz 1300 Hz				
PWM frequency	8 kHz		4 kHz		
Nominal input voltage	650V DC				
Continuous current (rms) ⁽²⁾	2.8 A	6.1 A	10.3 A	21.2 A	34.6 A
Continuous current (sine) 0-pk ⁽²⁾	4.0 A	8.6 A	14.6 A	30.0 A	48.9 A
Peak current (rms) ⁽²⁾ Series A drives Series B drives ⁽³⁾	4.2 A 7.0 A	9.2 A 15.3 A	15.5 A 25.8 A	31.8 A 53.0 A	51.9 A 69.2 A
Peak current (0-pk) ⁽²⁾ Series A drives Series B drives ⁽³⁾	5.9 A 9.9 A	12.9 A 21.6 A	21.8 A 36.4 A	45.0 A 75.0 A	73.4 A 97.9 A
Continuous power out (nom)	1.8 kW	3.9 kW	6.6 kW	13.5 kW	22.0 kW
Internal shunt Continuous power Peak power	50 W 5.6 kW			200 W 22.5 kW	
Internal shunt resistor	115 Ω			28.75 Ω	
Shunt on	805V DC				
Shunt off	755V DC				
Efficiency	98%				
Capacitance	75 μF	150 μF	270 μF	840 μF	1175 μF
Capacitive energy absorption	10 J	19 J	35 J	108 J	152 J
Short circuit current rating	200,000 A (rms) symmetrical				

(1) Bandwidth values vary based on tuning parameters and mechanical components.

(2) Continuous and peak current ratings are for high-speed operation. For constant velocity operation at an electrical output frequency below 5 Hz (75 rpm for 8-pole motors), the output current rating is reduced. See Motion Analyzer software to correctly size your drive. Refer to Peak Current Specifications on [page 71](#) for duty cycle capability specifications.

(3) Applies to Series B drives when configured for peak-enhanced mode. For more information on drive performance in the peak-enhanced mode, refer to Peak Enhancement Specifications on [page 69](#).

Shunt Module Power Specifications

The 2094-BSP2 shunt module is compatible with all 230V and 460V IAM and AM modules.

Table 101 - 2094-BSP2 Shunt Module Specifications

Shunt Module Cat. No.	Drive Voltage V AC	Resistance Ω	Peak Power kW	Peak Current A	Continuous Power W	Capacitance μF	Short Circuit Current Rating A	Fuse Replacement
2094-BSP2	230	28.75	5.7	14	200	470	200,000 symmetrical	N/A (no internal fuse)
	460		22.5	28				

For External Shunt Module Specifications, refer to [page 194](#).

Use this table to understand the 230V system shunt specifications for the IAM module internal shunt resistors, the 2094-BSP2 shunt module, and the Bulletin 1394 passive external shunt modules.

Table 102 - Shunt Module (230V) System Specifications

IAM Module 2094-	Number of Axis Modules Qty	Shunt Module Cat. No.	Shunt Module Specifications				External Passive Shunt Module ⁽¹⁾ Cat. No.	System Continuous Shunt Power W
			Resistance Ω	Peak Current A	Peak Power kW	Continuous Power W		
AC05-MP5-x	0 to 7	N/A ⁽²⁾	—	—	—	—	N/A ⁽²⁾	0
AC05-M01-x			—	—	—	—		0
AC09-M02-x			—	—	—	—		50 ⁽³⁾
AC16-M03-x			—	—	—	—		200 plus ⁽⁴⁾
AC32-M05-x			—	—	—	—		
ACxx-Mxx-x	0 to 6	2094-BSP2	28.75	14.1	5.7	200	N/A ⁽²⁾	200 plus ⁽⁵⁾
ACxx-Mxx-x	0 to 6	2094-BSP2	4	101.3	41	300	1394-SR9A	300 ⁽⁶⁾
ACxx-Mxx-x						900	1394-SR9AF	900 ⁽⁶⁾
ACxx-Mxx-x						1800	1394-SR36A	1800 ⁽⁶⁾
ACxx-Mxx-x						3600	1394-SR36AF	3600 ⁽⁶⁾

(1) Refer to [External Shunt Module Specifications](#) on page 194.

(2) Module not part of system configuration.

(3) 50 or the sum of the AM module internal shunt ratings.

(4) 200 plus the sum of the AM module internal shunt ratings.

(5) 200 plus the sum of the IAM module (2094-AC16-M03-x and 2094-AC32-M05-x only) and AM module internal shunt ratings.

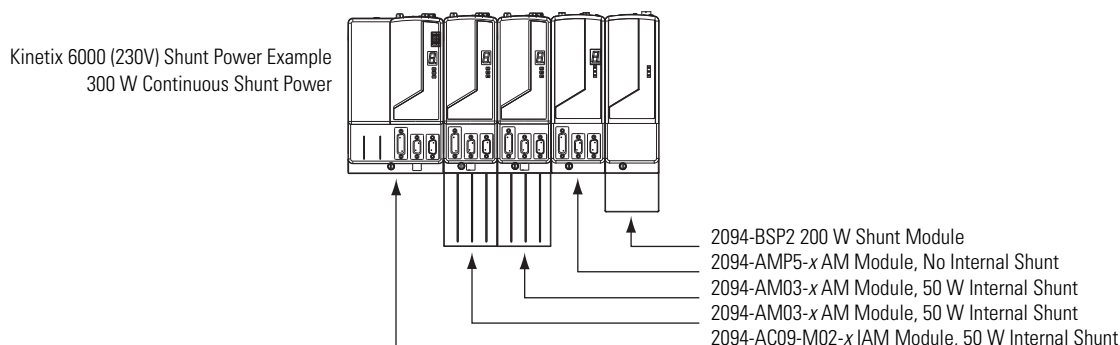
(6) Use of external shunt disables internal IAM/AM shunt modules.

IMPORTANT

The Kinetix 6000 shunt module, catalog number 2094-BSP2, used in combination with the 2094-AC09-M02-x IAM module, disables the internal IAM module shunt resistor. This situation is unique to the 2094-AC09-M02-x IAM module. Shunt resistors internal to adjacent AM modules are not disabled.

In this example, the continuous shunt power is 300 W. The 50 W resistor in the IAM module is disabled when used in combination with the (2094-BSP2) shunt module. This example is unique to the 2094-AC09-M02-*x* IAM module.

Figure 82 - 230V Shunt Power Example (2094-AC09-M02-*x*)



Use this table to understand the 460V system shunt specifications for the IAM module internal shunt resistors, the 2094-BSP2 shunt module, and the Bulletin 1394 passive external shunt modules.

Table 103 - Shunt Module (460V) System Specifications

IAM Module 2094-	Number of Axis Modules Qty	Shunt Module Cat. No.	Shunt Module Specifications				External Passive Shunt Module ⁽¹⁾	System Continuous Shunt Power W
			Resistance Ω	Peak Current A	Peak Power kW	Continuous Power W		
BC01-MP5- <i>x</i>	0...7	N/A ⁽²⁾	—	—	—	—	N/A ⁽²⁾	50 plus ⁽³⁾
BC01-M01- <i>x</i>			—	—	—	—		50 plus ⁽³⁾
BC02-M02- <i>x</i>			—	—	—	—		50 plus ⁽³⁾
BC04-M03- <i>x</i>	N/A	N/A	—	—	—	—	N/A	200 plus ⁽⁴⁾
BC07-M05- <i>x</i>	N/A	N/A	—	—	—	—	N/A	
BC $_{xx}$ -M $_{xx}$ - <i>x</i>	1...6	2094-BSP2	28.75	28	22.5	200	N/A ⁽²⁾	200 plus ⁽⁵⁾
BC $_{xx}$ -M $_{xx}$ - <i>x</i>	1...6	2094-BSP2	4	201.3	162	300	1394-SR9A	300 ⁽⁶⁾
BC $_{xx}$ -M $_{xx}$ - <i>x</i>						900	1394-SR9AF	900 ⁽⁶⁾
BC $_{xx}$ -M $_{xx}$ - <i>x</i>						1800	1394-SR36A	1800 ⁽⁶⁾
BC $_{xx}$ -M $_{xx}$ - <i>x</i>						3600	1394-SR36AF	3600 ⁽⁶⁾

(1) Refer to External Shunt Module Specifications on [page 194](#).

(2) Module not part of system configuration.

(3) 50 plus the sum of the AM module internal shunt ratings.

(4) 200 plus the sum of the AM module internal shunt ratings.

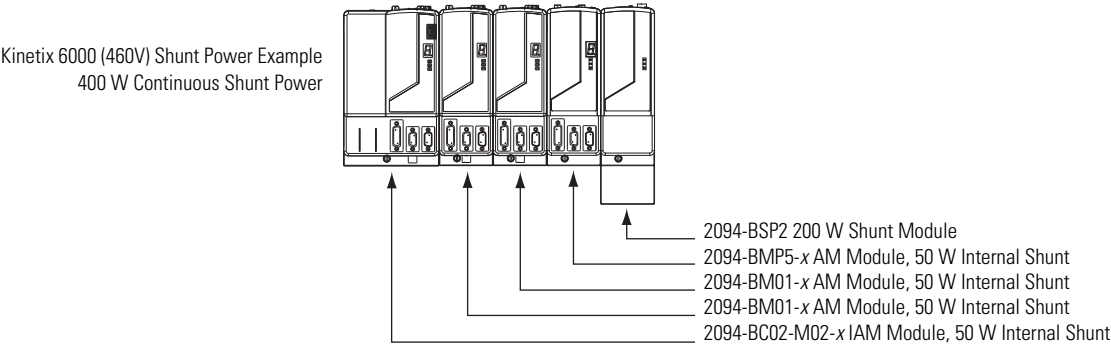
(5) 200 plus the sum of the IAM and AM module internal shunt ratings.

(6) Use of external shunt disables internal IAM/AM shunt modules.

In this example, the sum of the IAM/AM modules and shunt module equal 400 W of continuous shunt power.

TIP Shunt power adds up the same way for 230V (IAM/AM, and shunt module) systems too.

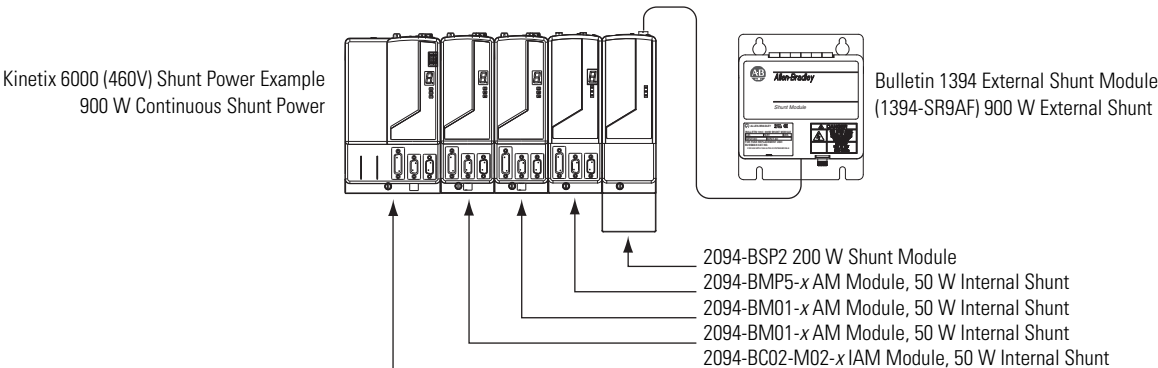
Table 104 - Shunt Power Example (without external shunt)



In this example, the system is identical to that shown in the previous example, except the 2094-BSP2 shunt module is wired to a Bulletin 1394 external shunt module. The IAM and AM power module internal shunt power is disabled and the continuous shunt power is equal to that of the external shunt module alone.

TIP The external shunt disables the internal shunt capacity of 230V (IAM/AM and shunt module) systems too.

Table 105 - Shunt Power Example (with external shunt)



Circuit Breaker/Fuse Specifications

While circuit breakers offer some convenience, there are limitations for their use. Circuit breakers do not handle high current inrush as well as fuses.

Circuit breakers not rated for branch circuit protection under UL 489, for example Bulletin 1492 devices, require upstream protection.

Use class CC, J, L, or R fuses, with current rating as indicated in the table below. These fuse examples and Allen-Bradley circuit breakers are recommended for use with 2094-*x*C*xx*-M*xx*-*x* IAM modules when the LIM module is not used.

IMPORTANT Line Interface Modules (catalog numbers 2094-AL*xx*S, 2094-BL*xx*S, and 2094-XL75S-C*x*) provide branch circuit protection to the IAM module. Follow all applicable NEC and local codes.

IAM/AM Module	V AC Input Power			Control Input Power		DC Common Bus Fuse	
	Bussmann Fuse	Allen-Bradley Circuit Breaker		Bussmann Fuse	Allen-Bradley Circuit Breaker	Bussmann Fuse	Ferraz Shawmut Fuse
		Disconnect	Magnetic Contactor				
2094-AC05-MP5- <i>x</i>	KTK-R-20 (20 A)	1492-SP3D300	140M-F8E-C16	FNQ-R-10 (10 A)	1492-SP2D060	N/A	A50P20-1
2094-AC05-M01- <i>x</i>						FWH-35B	A50P35-4
2094-AC09-M02- <i>x</i>	KTK-R-30 (30 A)	1492-SP3D400	140M-F8E-C20		1492-SP2D200	FWH-60B	A50P60-4
2094-AC16-M03- <i>x</i>	LPJ-45SP (45 A)	N/A	140U-H6C3-C50			FWH-125B	A50P125-4
2094-AC32-M05- <i>x</i>	LPJ-80SP (80 A)	N/A	140U-H6C3-C90				
2094-BC01-MP5- <i>x</i>	KTK-R-20 (20 A)	1492-SP3D300	140M-F8E-C32	FNQ-R-10 (10 A)	1492-SP2D060	N/A	A100P20-1
2094-BC01-M01- <i>x</i>						FWJ-40A	A100P40-1
2094-BC02-M02- <i>x</i>	KTK-R-30 (30 A)	1492-SP3D400	140M-F8E-C45		1492-SP2D060	FWJ-70A	A100P70-1
2094-BC04-M03- <i>x</i>	LPJ-45SP (45 A)	N/A	140U-H6C3-C50			FWJ-125A	A100P125-1
2094-BC07-M05- <i>x</i>	LPJ-80SP (80 A)		140U-H6C3-C90				

Refer to IAM Module (without LIM module), on [page 204](#), for the wiring diagram.



ATTENTION: Bulletin 1492, 140M, and 140U products should not be used on the output of an AC drive as an isolating disconnect switch or motor overload device. These devices are designed to operate on sine wave voltage and the drive's PWM waveform does not allow it to operate properly. As a result, damage to the device will occur.

Contactor Ratings

These tables list the recommended contactor ratings for IAM modules installed without a LIM module.

Table 106 - Contactor Ratings for 230V Systems

IAM Module (230V) Cat. No.	Contactor
2094-AC05-MP5-x	100-C23x10 (AC coil) 100-C23Zx10 (DC coil)
2094-AC05-M01-x	
2094-AC09-M02-x	100-C37x10 (AC coil) 100-C37Zx10 (DC coil)
2094-AC16-M03-x	100-C72x10 (AC coil) 100-C72Zx10 (DC coil)
2094-AC32-M05-x	100-C85x10 (AC coil) 100-C85Zx10 (DC coil)

Table 107 - Contactor Ratings for 460V Systems

IAM Module (460V) Cat. No.	Contactor
2094-BC01-MP5-x	100-C23x10 (AC coil) 100-C23Zx10 (DC coil)
2094-BC01-M01-x	
2094-BC02-M02-x	100-C37x10 (AC coil) 100-C37Zx10 (DC coil)
2094-BC04-M03-x	100-C60x10 (AC coil) 100-C60Zx10 (DC coil)
2094-BC07-M05-x	100-C72x10 (AC coil) 100-C72Zx10 (DC coil)

Transformer Specifications for Control Power Input

Attribute	Value (460V system)
Input volt-amperes	750VA
Input voltage	460V AC
Output voltage	120...240V AC

Power Dissipation Specifications

Use this table to size an enclosure and calculate required ventilation for your Kinetix 6000 drive system.

Kinetix 6000 ⁽¹⁾ Drive Modules	Usage as % of Rated Power Output (watts)				
	20%	40%	60%	80%	100%
IAM (converter) module ⁽²⁾					
2094-AC05-MP5- <i>x</i>	8	11	15	19	24
2094-AC05-M01- <i>x</i>	9	12	16	20	25
2094-AC09-M02- <i>x</i>	14	20	28	36	46
2094-AC16-M03- <i>x</i>	19	30	43	58	74
2094-AC32-M05- <i>x</i>	41	68	100	136	176
2094-BC01-MP5- <i>x</i>	18	21	25	29	34
2094-BC01-M01- <i>x</i>					33
2094-BC02-M02- <i>x</i>	36	44	54	64	75
2094-BC04-M03- <i>x</i>	50	67	87	110	135
2094-BC07-M05- <i>x</i>	71	101	137	179	226
IAM (inverter) module or AM module ⁽²⁾					
2094-AC05-MP5- <i>x</i> or 2094-AMP5- <i>x</i>	28	32	37	41	46
2094-AC05-M01- <i>x</i> or 2094-AM01- <i>x</i>	31	38	46	54	62
2094-AC09-M02- <i>x</i> or 2094-AM02- <i>x</i>	34	45	57	70	84
2094-AC16-M03- <i>x</i> or 2094-AM03- <i>x</i>	48	68	91	116	144
2094-AC32-M05- <i>x</i> or 2094-AM05- <i>x</i>	104	156	212	274	342
2094-BC01-MP5- <i>x</i> or 2094-BMP5- <i>x</i>	46	54	61	69	77
2094-BC01-M01- <i>x</i> or 2094-BM01- <i>x</i>	57	73	90	108	126
2094-BC02-M02- <i>x</i> or 2094-BM02- <i>x</i>	53	72	93	116	142
2094-BC04-M03- <i>x</i> or 2094-BM03- <i>x</i>	94	130	169	211	255
2094-BC07-M05- <i>x</i> or 2094-BM05- <i>x</i>	121	183	252	326	407
Shunt module					
2094-BSP2	68	121	174	227	280

(1) Power dissipation for the Bulletin 2094 control modules, catalog numbers 2094-SE02F-M00-Sx and 2094-EN02D-M01-Sx, is included in the IAM and AM power module specifications.

(2) Internal shunt power is not included in the calculations and must be added based on utilization.

Power dissipation specifications are based on these calculations. For example:

2094-BC02-M02-*x* with 4.52 A_{dc} (=20%) converter DC current and 10.3 A_{rms} (=100%) inverter output current.

Converter loss (36 W) + Inverter loss (142 W) = 178 W total power dissipation.

General Specifications

This section contains general specifications for your Kinetix 6000 system components.

Maximum Feedback Cable Lengths

Although motor feedback cables are available in standard lengths up to 90 m (295.3 ft), the drive/motor/feedback combination may limit the maximum cable length. These tables assume the use of recommended 2090-series cables.

Table 108 - Cable Lengths for Compatible Rotary Motors

Motor Cat. No.	Absolute High-resolution (5V) Encoder m (ft)	Absolute High-resolution (9V) Encoder m (ft)	Incremental/TTL (5V) Encoder m (ft)	Resolver m (ft)
MPL-A15xxx... MPL-A2xxx-E/V	30 (98.4)			
MPL-A3xxx... MPL-A5xxx-S/M	30 (98.4)			
MPL-B15xxx... MPL-B2xxx-E/V		90 (295.3)		
MPL-B3xxx... MPL-B5xxx-S/M		90 (295.3)		
MPL-A/B15xxx... MPL-A/B45xxx-H			30 (98.4)	
MPL-Bxxxx-R				90 (295.3)
MPM-Axxxxx-S/M	30 (98.4)			
MPM-Bxxxxx-S/M		90 (295.3)		
MPM-A/Bxxxxx-2				90 (295.3)
MPF-Axxxx-S/M	30 (98.4)			
MPF-Bxxxx-S/M		90 (295.3)		
MPS-Axxxx-S/M	30 (98.4)			
MPS-Bxxxx-S/M		90 (295.3)		
1326AB-Bxxxx-M2L/S2L		90 (295.3)		
1326AB-Bxxxx-21				90 (295.3)
RDB-B215xx-7/3	30 (98.4)			
RDB-B290xx-7/3 or RDB-B410xx-7/3	90 (295.3)			
TLY-Axxxx-H			30 (98.4)	

Table 109 - Cable Lengths for Compatible Linear Actuators

Actuator Cat. No.	Absolute High-resolution (9V) Encoder m (ft)	Absolute High-resolution (5V) Encoder m (ft)	Incremental/TTL (5V) Encoder m (ft)
MPMA-Axxxx or MPAS-Axxxx-V (ballscrew)		30 (98.4)	
MPMA-Bxxxxx or MPAS-Bxxxxx-A (direct drive)			30 (98.4)
MPMA-Bxxxxx or MPAS-Bxxxxx-V (ballscrew)	90 (295.3)		
MPMA-Bxxxxx or MPAS-Bxxxxx-A (direct drive)			30 (98.4)
MPAR-Axxxxx-V/M		30 (98.4)	
MPAR-Bxxxxx-V/M	90 (295.3)		
MPAI-AxxxxxM3		30 (98.4)	
MPAI-BxxxxxM3	90 (295.3)		

Table 110 - Cable Lengths for Compatible Linear Motors

Motor Cat. No.	Absolute High-resolution (5V) Encoder m (ft)	Incremental/TTL (5V) Encoder m (ft)
LDC-Series or LDL-Series	30 (98.4)	30 (98.4)

Maximum Power Cable Length

Combined motor power cable length for all axes on the same DC bus must not exceed 240 m (787 ft) with 460V systems or 160 m (525 ft) with 230V systems. Drive-to-motor power cables must not exceed 90 m (295.5 ft).

IMPORTANT

System performance was tested at these cable length specifications. These limitations also apply when meeting CE requirements.

Weight Specifications

Kinetix 6000 System Component	Cat. No.	Weight, approx. kg (lb)	Kinetix 6000 System Component	Cat. No.	Weight, approx. kg (lb)
IAM (230V)	2094-AC05-MP5- <i>x</i>	2.23 (4.9)	AM (230V)	2094-AMP5- <i>x</i>	1.46 (3.2)
	2094-AC05-M01- <i>x</i>	2.27 (5.0)		2094-AM01- <i>x</i>	1.50 (3.3)
	2094-AC09-M02- <i>x</i>	2.31 (5.1)		2094-AM02- <i>x</i>	1.54 (3.4)
	2094-AC16-M03- <i>x</i>	4.71 (10.4)		2094-AM03- <i>x</i>	3.13 (6.9)
	2094-AC32-M05- <i>x</i>	7.43 (16.4)		2094-AM05- <i>x</i>	3.18 (7.0)
IAM (460V)	2094-BC01-MP5- <i>x</i>	4.98 (11.0)	AM (460V)	2094-BMP5- <i>x</i>	2.44 (5.4)
	2094-BC01-M01- <i>x</i>	5.03 (11.1)		2094-BM01- <i>x</i>	2.49 (5.5)
	2094-BC02-M02- <i>x</i>	5.08 (11.2)		2094-BM02- <i>x</i>	2.54 (5.6)
	2094-BC04-M03- <i>x</i>	9.60 (21.1)		2094-BM03- <i>x</i>	4.58 (10.1)
	2094-BC07-M05- <i>x</i>	10.1 (22.3)		2094-BM05- <i>x</i>	4.98 (11.0)
Power Rails (Slim)	2094-PRS1	1.05 (2.3)	Power Rails	2094-PR1	1.04 (2.3)
	2094-PRS2	1.59 (3.5)		2094-PR2	1.41 (3.1)
	2094-PRS3	2.14 (4.7)		2094-PR4	2.18 (4.8)
	2094-PRS4	2.67 (5.9)		2094-PR6	2.90 (6.4)
	2094-PRS5	3.11 (6.8)		2094-PR8	3.63 (8.0)
	2094-PRS6	3.55 (7.8)	Shunt Module	2094-BSP2	3.10 (6.8)
	2094-PRS7	3.99 (8.8)	Slot-filler Module	2094-PRF	0.45 (1.0)
	2094-PRS8	4.43 (9.7)			

Certifications

Agency Certification ⁽¹⁾	Standards
c-UL-us ⁽²⁾	UL Listed to U.S. and Canadian safety standards (UL 508C File E59272).
	Solid-state motor overload protection provides dynamic fold-back of motor current when 110% of the motor rating is reached with a peak current limit based on the peak rating of the motor as investigated by UL to comply with UL 508C (UL File E59272, volume 1, section 22).
CE	European Union 2004/108/EC EMC Directive compliant with EN 61800-3:2004: Adjustable Speed Electrical Power Drive Systems - Part 3; EMC Product Standard including specific test methods.
	European Union 2006/95/EC Low Voltage Directive compliant with: - EN 61800-5-1:2003 - Safety of Machinery - Electrical Equipment of Machines. - EN 50178:1997 - Electronic Equipment for use in Power Installations.
Functional Safety	- EN 60204-1:1997 - Safety of Machinery - Electrical Equipment of Machines. - IEC 61508: Part 1-7:2000 - Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems. - EN954-1:1996 - Safety of machinery. Safety related parts of control systems. Part 1: General principles for design.

(1) When product is marked, refer to <http://www.ab.com> for Declarations of Conformity Certificates.

(2) Underwriters Laboratories Inc. has not evaluated the safe-off, safe torque-off, or safe speed-monitoring options in these products.

Environmental Specifications

Specification	Operational Range	Storage Range (nonoperating)
Ambient temperature	0...50 °C (32...122 °F)	-40...70 °C (-40...158 °F)
Relative humidity	5...95% noncondensing	5...95% noncondensing
Altitude	1000 m (3281 ft)	3000 m (9843 ft) during transport
Vibration	5...55 Hz @ 0.35 mm (0.014 in.) double amplitude, continuous displacement; 55...500 Hz @ 2.0 g peak constant acceleration	
Shock	15 g, 11 ms half-sine pulse (3 pulses in each direction of 3 mutually perpendicular directions)	

AC Line Filter Specifications

The tables below contain specifications for AC line filters available for Kinetix 6000 servo drive systems.

Table 111 - AC Line Filter Specifications

AC Line Filter Cat. No.	Voltage	Phase	Current	Power Loss W	Leakage Current mA	Weight kg (lb)	Humidity	Vibration	Operating Temperature
2090-XXLF-X330B	500V AC 50/60 Hz	Three	30 A @ 50 °C (122 °F)	38	64	2.7 (5.9)	90% RH	10...200 Hz @ 1.8 g	-25...85 °C (-13...185 °F)
2090-XXLF-375			75 A @ 50 °C (122 °F)	57	50	5.2 (11.4)			
2090-XXLF-375B					108				
2090-XXLF-3100			100 A @ 50 °C (122 °F)	75	73	9.5 (20.9)			

Table 112 - AC Line Filter Selection

IAM Module Cat. No.	AC Line Filter Cat. No.
2094-AC05-MP5- <i>x</i>	2090-XXLF-X330B
2094-AC05-M01- <i>x</i>	
2094-AC09-M02- <i>x</i>	
2094-AC16-M03- <i>x</i>	2090-XXLF-375
2094-AC32-M05- <i>x</i>	2090-XXLF-3100
2094-BC01-MP5- <i>x</i>	2090-XXLF-X330B
2094-BC01-M01- <i>x</i>	
2094-BC02-M02- <i>x</i>	
2094-BC04-M03- <i>x</i>	2090-XXLF-375B
2094-BC07-M05- <i>x</i>	2090-XXLF-3100

External Shunt Module Specifications

Bulletin 1394 passive shunt modules wire to the 2094-BSP2 (power rail mounted) shunt module.

Table 113 - Bulletin 1394 Passive Shunt Module Specifications

External Shunt Module Cat. No.	Drive Voltage V AC	Resistor Value Ω	Peak Power kW	Peak Current A	Continuous Power W	Shipping Weight kg (lb)	Bussmann Replacement Fuse
1394-SR9A	230 ⁽¹⁾	4	41.0	101.25	300	3.63 (8)	FNQ-R-20-R1 ⁽¹⁾
	460		160.0	200			FWP50A14F
1394-SR9AF	230 ⁽¹⁾	4	41.0	101.25	900	3.63 (8)	FNQ-R-20-R1 ⁽¹⁾
	460		160.0	200			FWP50A14F
1394-SR36A	230 ⁽¹⁾	4	41.0	101.25	1800	8.6 (19)	FNQ-R-20-R1 ⁽¹⁾
	460		160.0	200			FWP50A14F
1394-SR36AF	230 ⁽¹⁾	4	41.0	101.25	3600	9.0 (20)	FNQ-R-25-R1 ⁽¹⁾
	460		160.0	200			FWP50A14F

(1) Requires the use of an FNQ fuse with an adapter to allow the smaller body fuse to fit the larger FWP fuse holder.

Bulletin 1336 active shunt modules wire directly to the DC bus.

Table 114 - Bulletin 1336 Chopper Shunt Module Specifications

External Shunt Module Cat. No.	Drive Voltage V AC	Turn-on Value V	Peak Transistor Current A	Resistor Value, min ⁽¹⁾ Ω	Shipping Weight kg (lb)	Fuse Replacement (Ferraz Shawmut)
1336-WA115	230	375	400	1.25	11.34 (25)	A70Q
1336-WA070			200	2.3	4.08 (9)	A70Q
1336-WA018			50	9.0	3.18 (7)	A60Q
1336-WB110	460	750	400	2.5	11.34 (25)	A70Q
1336-WB035			100	9.0	4.08 (9)	A70Q
1336-WB009			25	37.0	3.18 (7)	A60Q

(1) Customer-supplied component.

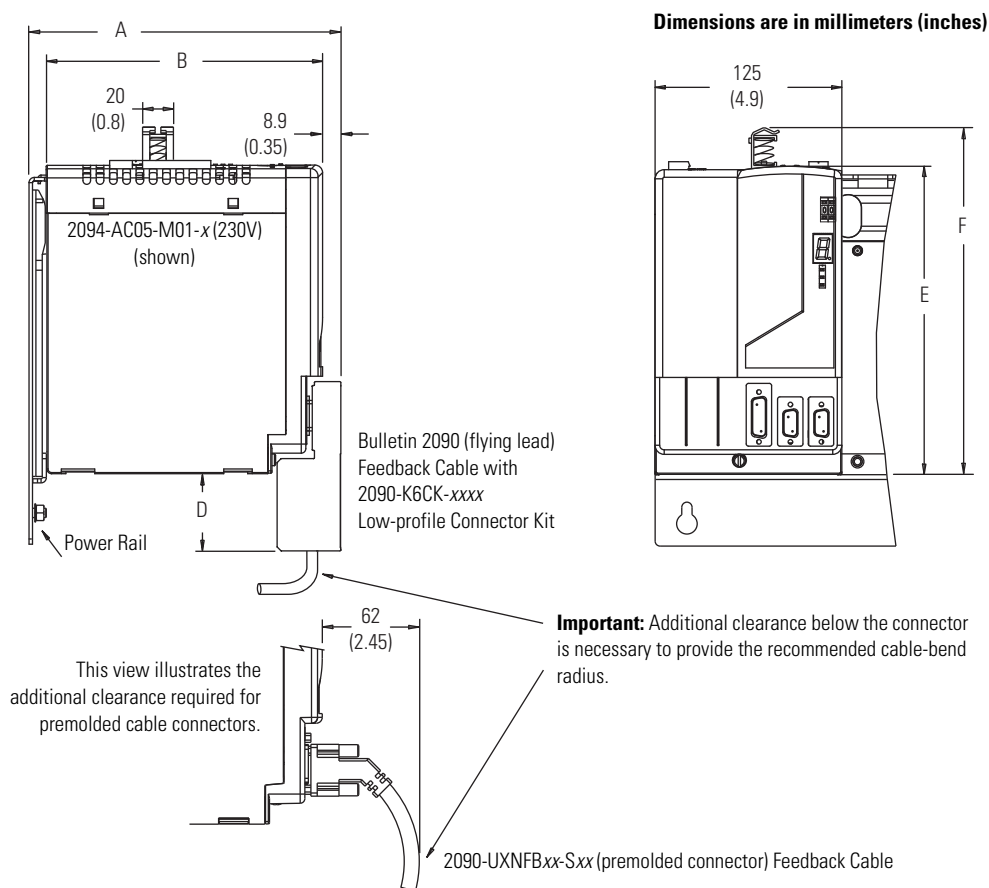
Refer to the Common DC Bus Selection Guide, publication [DRIVES-SG001](#), for dimensions and catalog number information for the Bulletin 1336 active shunt modules.

Product Dimensions

This section contains product dimensions for your Kinetix 6000 system components.

Figure 83 - IAM Module Dimensions

2094-AC05-MP5-x, 2094-AC05-M01-x, and 2094-AC09-M02-x (230V)
2094-BC01-MP5-x, 2094-BC01-M01-x, and 2094-BC02-M02-x (460V)

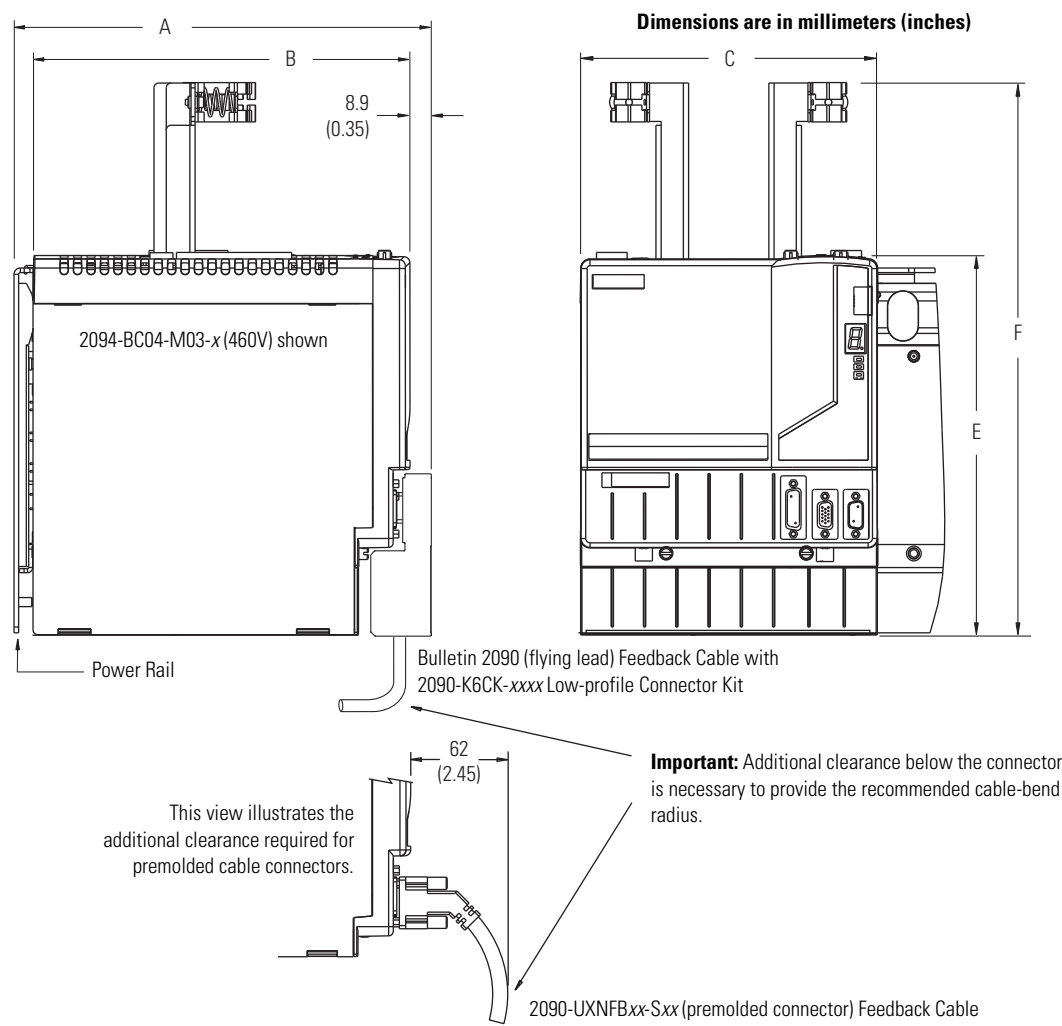


The IAM module is shown mounted to the power rail.

Table 115 - IAM Module Dimensions

IAM Module Cat. No.	A mm (in.)	B mm (in.)	D mm (in.)	E mm (in.)	F mm (in.)
2094-AC05-MP5-x	198 (7.8)	176 (7.0)	51 (2.0)	206 (8.2)	231 (9.1)
2094-AC05-M01-x					
2094-AC09-M02-x					
2094-BC01-MP5-x	272 (10.7)	249 (9.8)	0 (0)	256 (10.1)	281 (11.0)
2094-BC01-M01-x					
2094-BC02-M02-x					

Figure 84 - IAM Module Dimensions
2094-AC16-M03-x and 2094-AC32-M05-x (230V)
2094-BC04-M03-x and 2094-BC07-M05-x (460V)

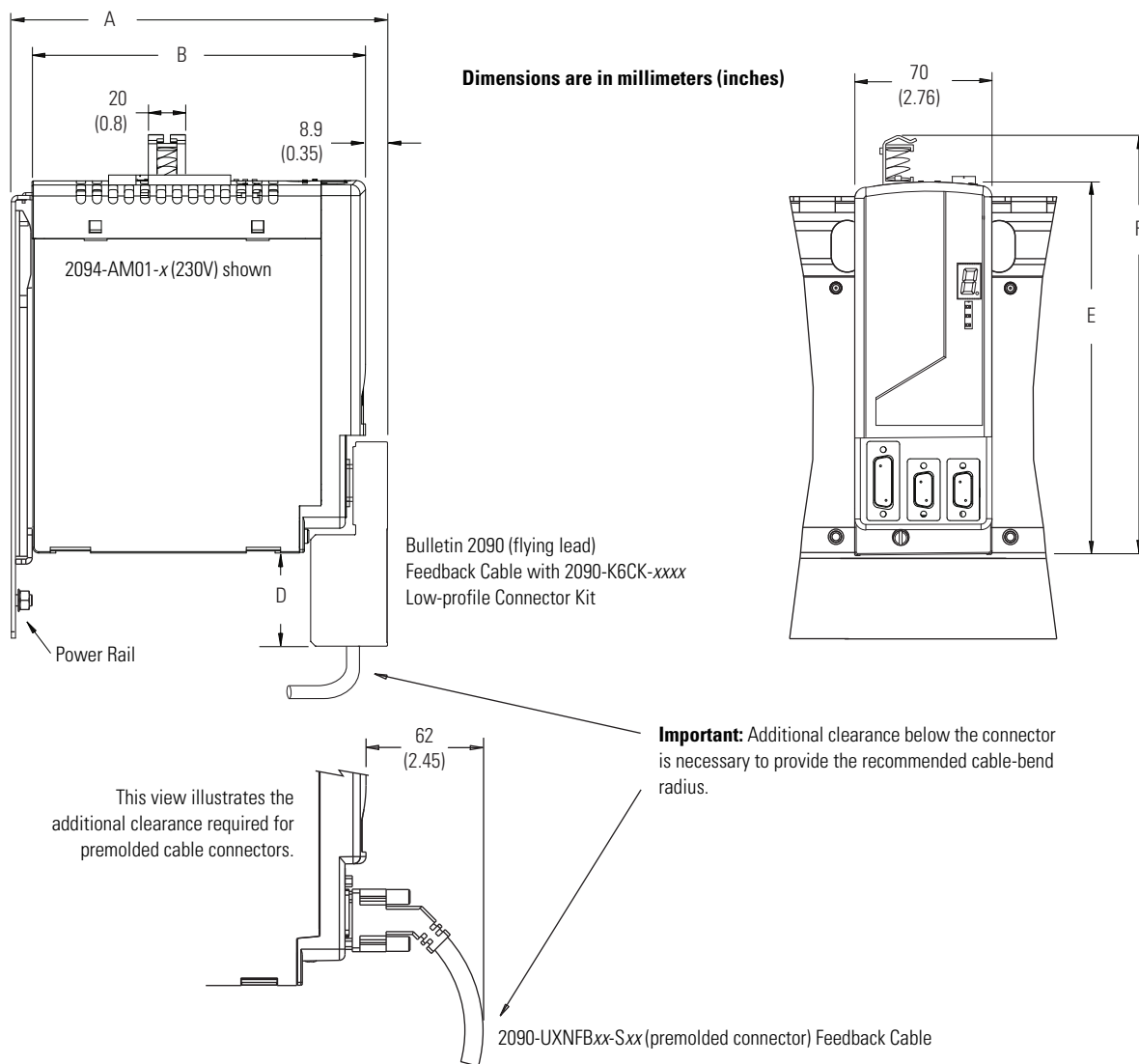


The IAM module is shown mounted to the power rail.

Table 116 - IAM Module Dimensions

IAM Module Cat. No.	A mm (in.)	B mm (in.)	C mm (in.)	E mm (in.)	F mm (in.)
2094-AC16-M03-x	198 (7.8)	176 (7.0)	125 (4.9)	302 (11.9)	420 (16.5)
2094-AC32-M05-x			196 (7.7)		
2094-BC04-M03-x	272 (10.7))	249 (9.8)	196 (7.7)	256 (10.1)	374 (14.7)
2094-BC07-M05-x				318 (12.5)	436 (17.2)

Figure 85 - AM Module Dimensions
2094-AMP5-x, 2094-AM01-x, and 2094-AM02-x (230V)
2094-BMP5-x, 2094-BM01-x, and 2094-BM02-x (460V)

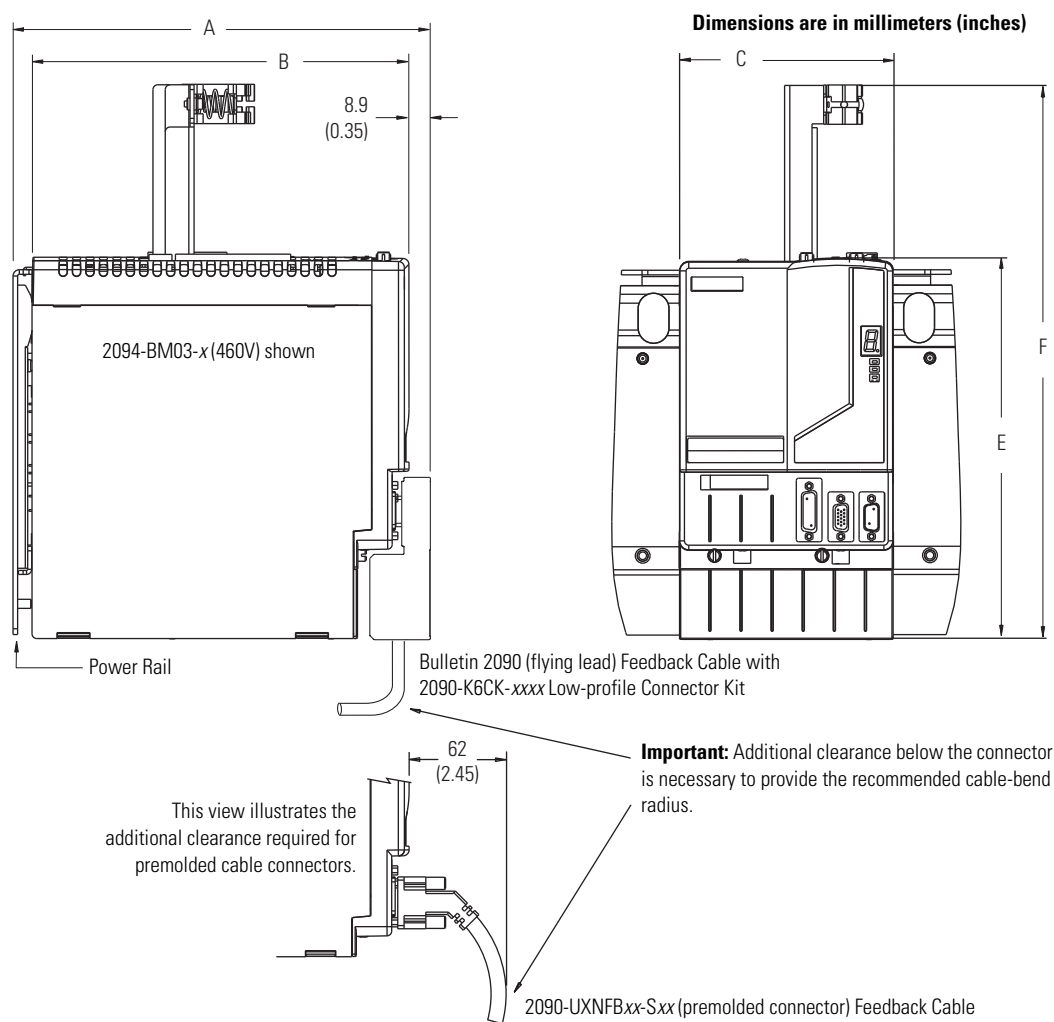


The AM module is shown mounted to the power rail.

Table 117 - AM Module Dimensions

AM Module Cat. No.	A mm (in.)	B mm (in.)	D mm (in.)	E mm (in.)	F mm (in.)
2094-AMP5-x	198 (7.8)	176 (7.0)	51 (2.0)	206 (8.2)	231 (9.1)
2094-AM01-x					
2094-AM02-x					
2094-BMP5-x	272 (10.7)	249 (9.8)	0 (0)	256 (10.1)	281 (11.0)
2094-BM01-x					
2094-BM02-x					

Figure 86 - AM Module Dimensions
2094-AM03-x and 2094-AM05-x (230V)
2094-BM03-x and 2094-BM05-x (460V)



The AM power module is shown mounted to the power rail.

Table 118 - AM Module Dimensions

AM Module Cat. No.	A mm (in.)	B mm (in.)	C mm (in.)	E mm (in.)	F mm (in.)
2094-AM03-x	198 (7.8)	176 (7.0)	70 (2.8)	302 (11.9)	420 (16.5)
2094-AM05-x					
2094-BM03-x	272 (10.7)	249 (9.8)	141 (5.5)	256 (10.1)	374 (14.7)
2094-BM05-x				318 (12.5)	436 (17.2)

Interconnect Diagrams

Introduction

This appendix provides wiring examples and system block diagrams for your Kinetix 6000 system components.

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Axis Module/Rotary Motor Wiring Examples	212
Axis Module/Linear Motor/Actuator Wiring Examples	220
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System Block Diagrams	225

Interconnect Diagram Notes

This appendix provides wiring examples to assist you in wiring the Kinetix 6000 drive system. These notes apply to the wiring examples on the following pages.

Note	Information
1	For power wiring specifications, refer to Power Wiring Requirements on page 91 .
2	For input fuse and circuit breaker sizes, refer to Circuit Breaker/Fuse Specifications on page 187 .
3	Place AC (EMC) line filters as close to the drive as possible and do not route very dirty wires in wireway. If routing in wireway is unavoidable, use shielded cable with shields grounded to the drive chassis and filter case. For AC line filter specifications, refer to AC Line Filter Specifications on page 193 .
4	Terminal block is required to make connections.
5	2094-BCxx-Mxx-x (460V) IAM modules require a step down transformer for single-phase control power input with neither leg of the transformer secondary bonded to ground or neutral potential. Source the 2094-ACxx-Mxx-x (230V) IAM module control power from the three-phase input power (line-to-line). Supplying control power from any other source requires an isolation transformer. The National Electrical Code and local electrical codes take precedence over the values and methods provided. Implementation of these codes is the responsibility of the machine builder.
6	2094-ALxxS and 2094-BLxxS and 2094-XL75S-C2 LIM modules can supply input power for up to eight axes. 2094-XL75S-C1 LIM modules can supply input power for up to sixteen axes. For common-bus systems with more than sixteen axes, multiple LIM modules (or control power transformers) are required.
7	2094-ALxxS, 2094-BLxxS, and 2094-XL75S-Cx LIM modules are capable of connecting to two IAM modules, providing each IAM module has its own line filter and the maximum current specification is not exceeded.
8	Contactor coil (M1) needs integrated surge suppressors for AC coil operation. Refer to Contactor Ratings on page 188 .
9	Drive Enable input must be opened when main power is removed, or a drive fault will occur. A delay of at least 1.0 second must be observed before attempting to enable the drive after main power is restored.
10	Cable shield clamp must be used to meet CE requirements. No external connection to ground is required.
11	Default configuration for jumper is for grounded power at user site. Ungrounded sites must jumper the bleeder resistor to prevent high electrostatic buildup. Refer to Determine the Input Power Configuration on page 79 for more information.
12	Leave jumper between PR2 and PR3 as shown to use the internal pre-charge resistor. Remove jumper when external pre-charge/circuit is required. For more information, refer to the 8720MC Regenerative Power Supply Installation Manual, publication 8720MC-RM001 .
13	 ATTENTION: Implementation of safety circuits and risk assessment is the responsibility of the machine builder. Please reference international standards EN 1050 and EN 954 estimation and safety performance categories. For more information refer to Understanding the Machinery Directive, publication SHB-900 .
14	 ATTENTION: Wiring the contactor enable relay is required. Refer to Contactor Enable Relay on page 66 , for more information. The recommended minimum wire size for wiring the safety circuit to the contactor enable connector is 1.5 mm ² (16 AWG).
15	The Bulletin 2094 axis module referenced is either an individual axis module (catalog number 2094-xMxx-x) or the same axis module that resides within an integrated axis module (catalog number 2094-xCxx-Mxx-x).
16	For motor cable specifications, refer to the Kinetix Motion Control Selection Guide, publication GMC-SG001 .
17	Wire colors are for flying-lead cable and may vary from the premolded cable connectors.
18	Motor power cables (2090-XXNPMF-xxSxx and 2090-CPBM6DF-16AAxx) have a drain wire that must be folded back under the cable shield clamp.
19	MPL-A15xx, MPL-A2xx, MPM-Axxx, MPF-A3xx, MPF-A4xx, MPF-A45xx, MPS-Axxx, MPAR-Axxx, and MPAS-Axxx encoders use the +5V DC supply. MPL-B15xx, MPL-B2xx, MPF-A5xx, MPM-Bxxx, MPF-Bxxx, MPS-Bxxx, MPAR-Bxxx, and MPAS-Bxxx encoders use +9V DC.
20	Brake connector pins are labeled plus (+) and minus (-) or F and G respectively. Power connector pins are labeled U, V, W, and GND or A, B, C, and D respectively.
21	Only the MPL-A5xx encoders use the +9V DC supply. MPL-A3xx, MPL-A4xx, MPL-A45xx encoders use the +5V DC supply.

Power Wiring Examples

Figure 87
Single IAM Module with 2094-AL09 or 2094-BL02 LIM Module

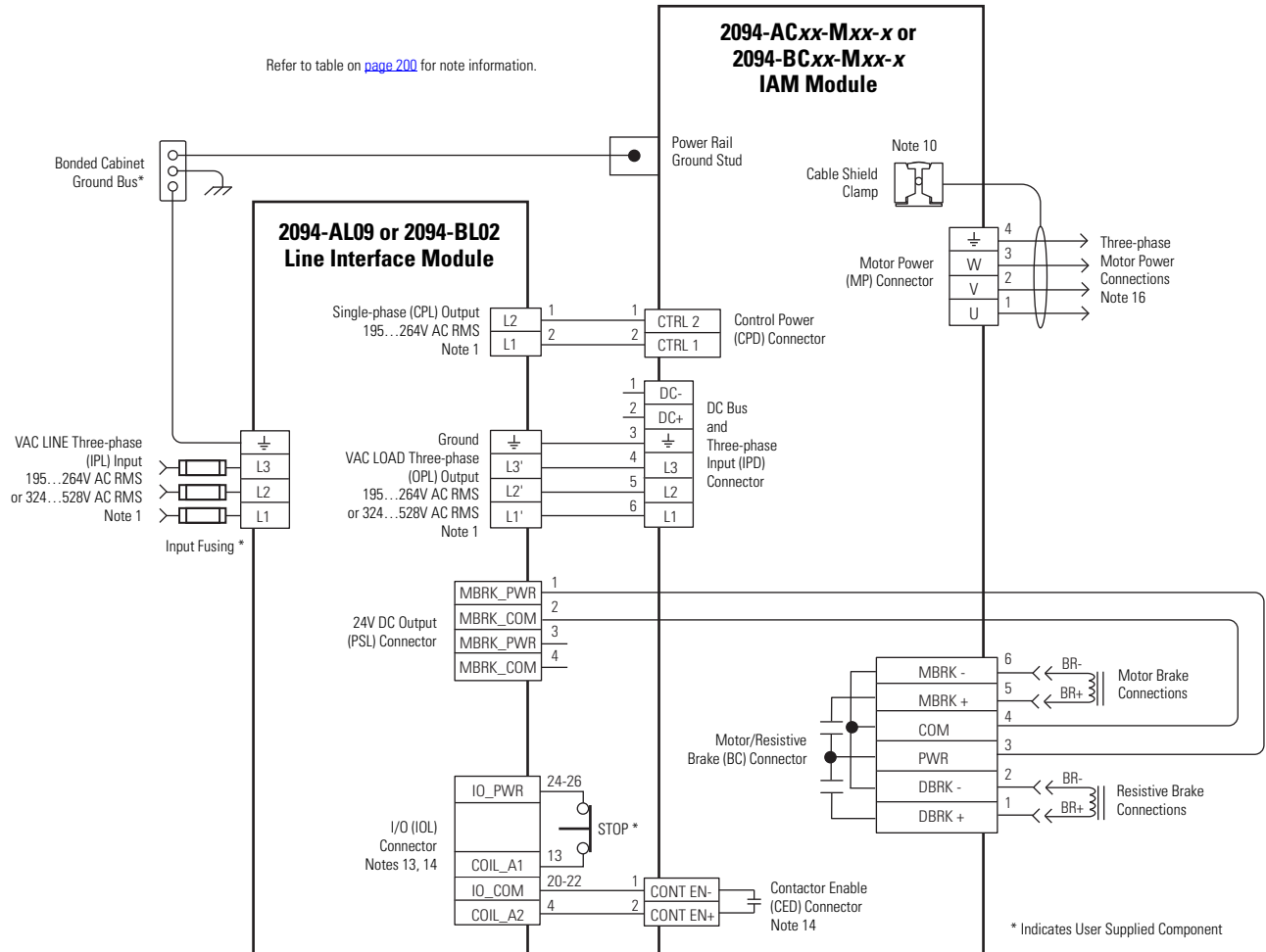
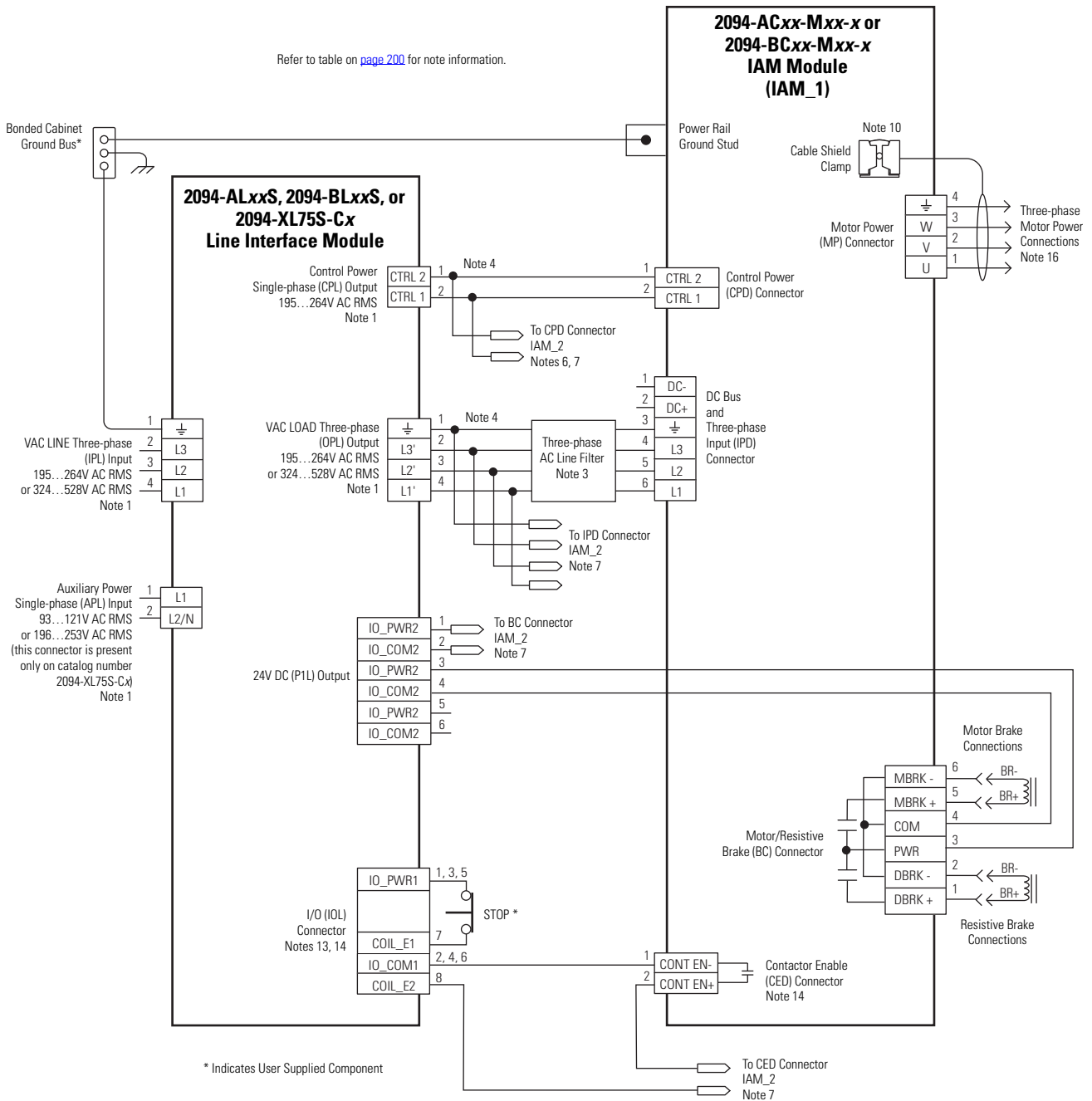
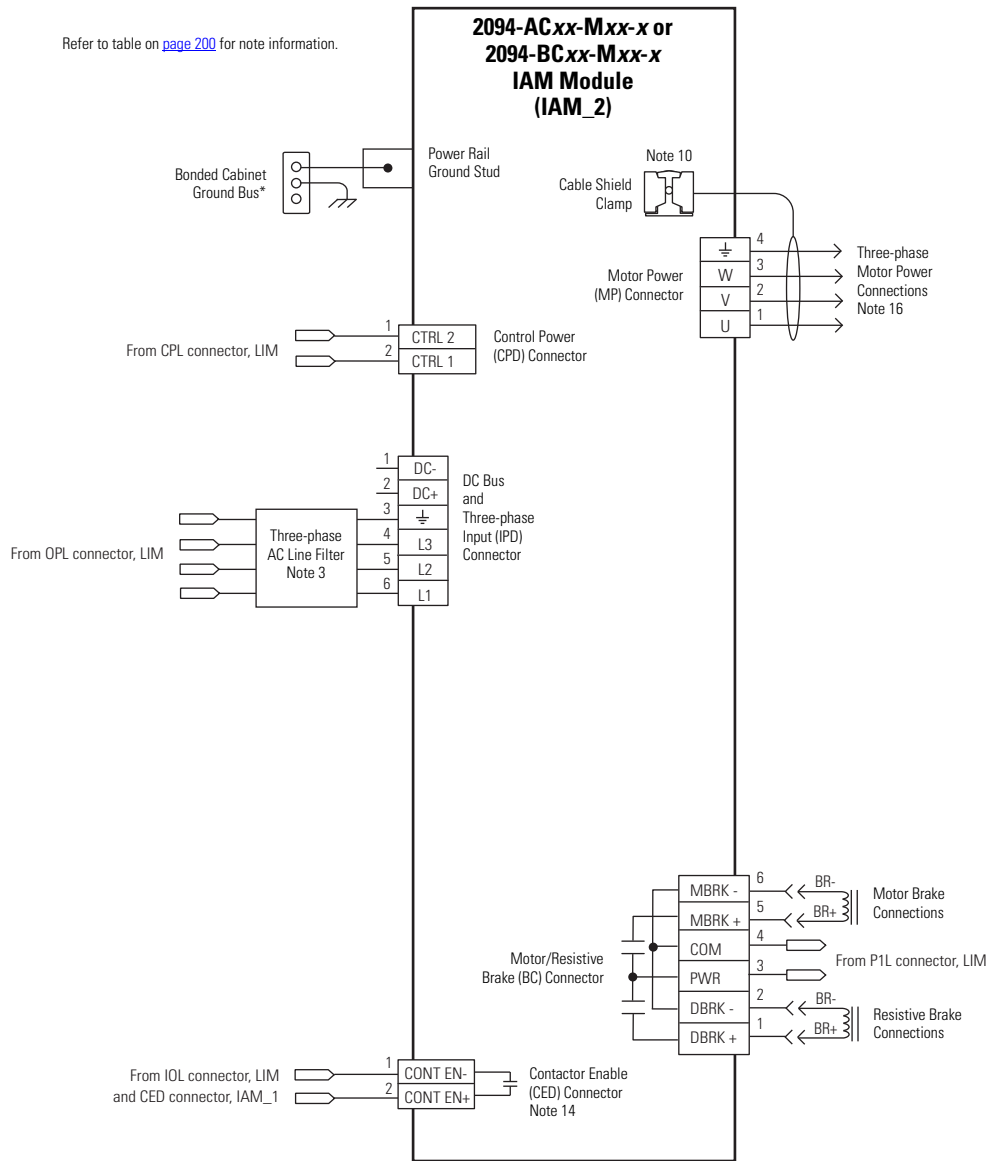


Figure 88
Multiple IAM Module with LIM Module



Multiple IAM Module with LIM Module (Continued)



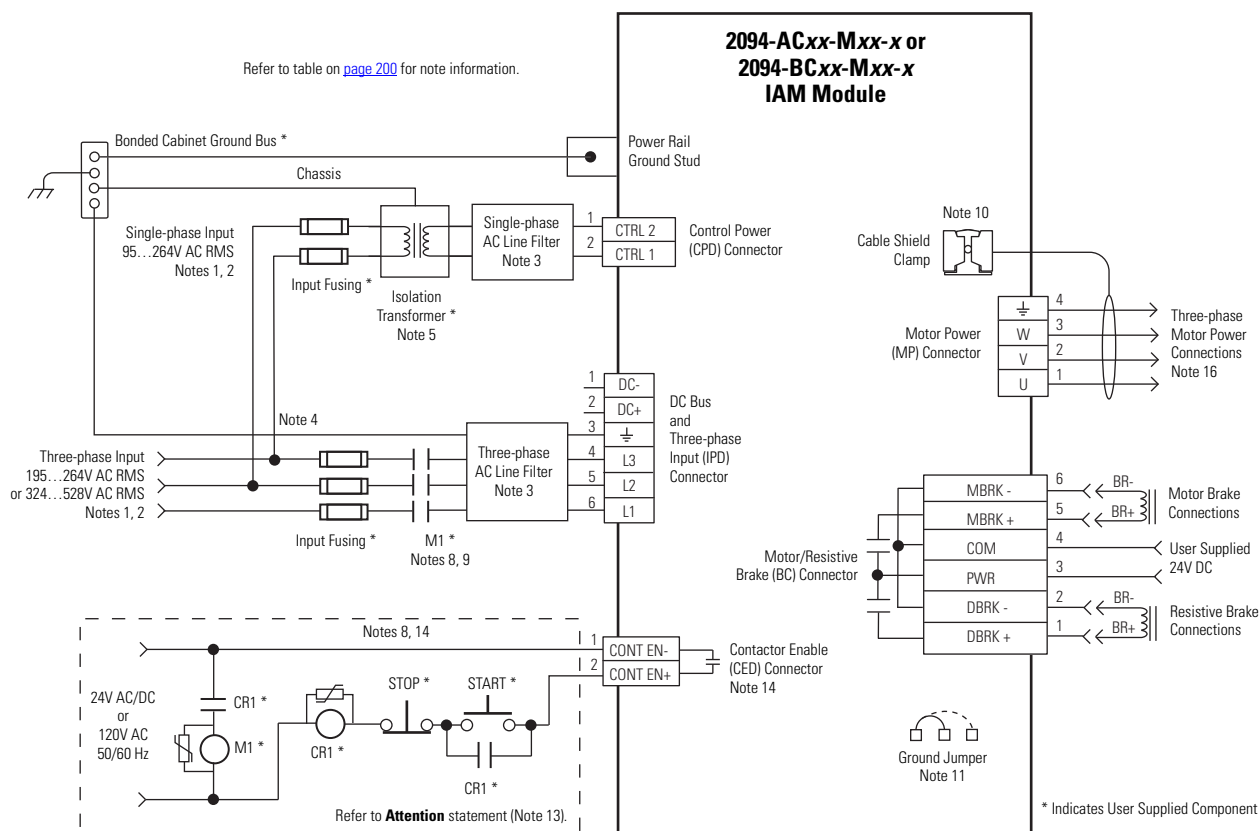
This configuration does not include a LIM module. You must supply input power components. The single-phase and three-phase line filters are wired downstream of fusing and the M1 contactor.



ATTENTION: Wiring the contactor enable (CED) relay is required. To avoid injury or damage to the drive, wire the contactor enable relay into your safety control string.

Refer to Contactor Enable Relay on [page 66](#), for more information.

Figure 89
IAM Module (without LIM module)



DC Common Bus Wiring Examples

Figure 90
Leader IAM Module with Single Follower IAM Module

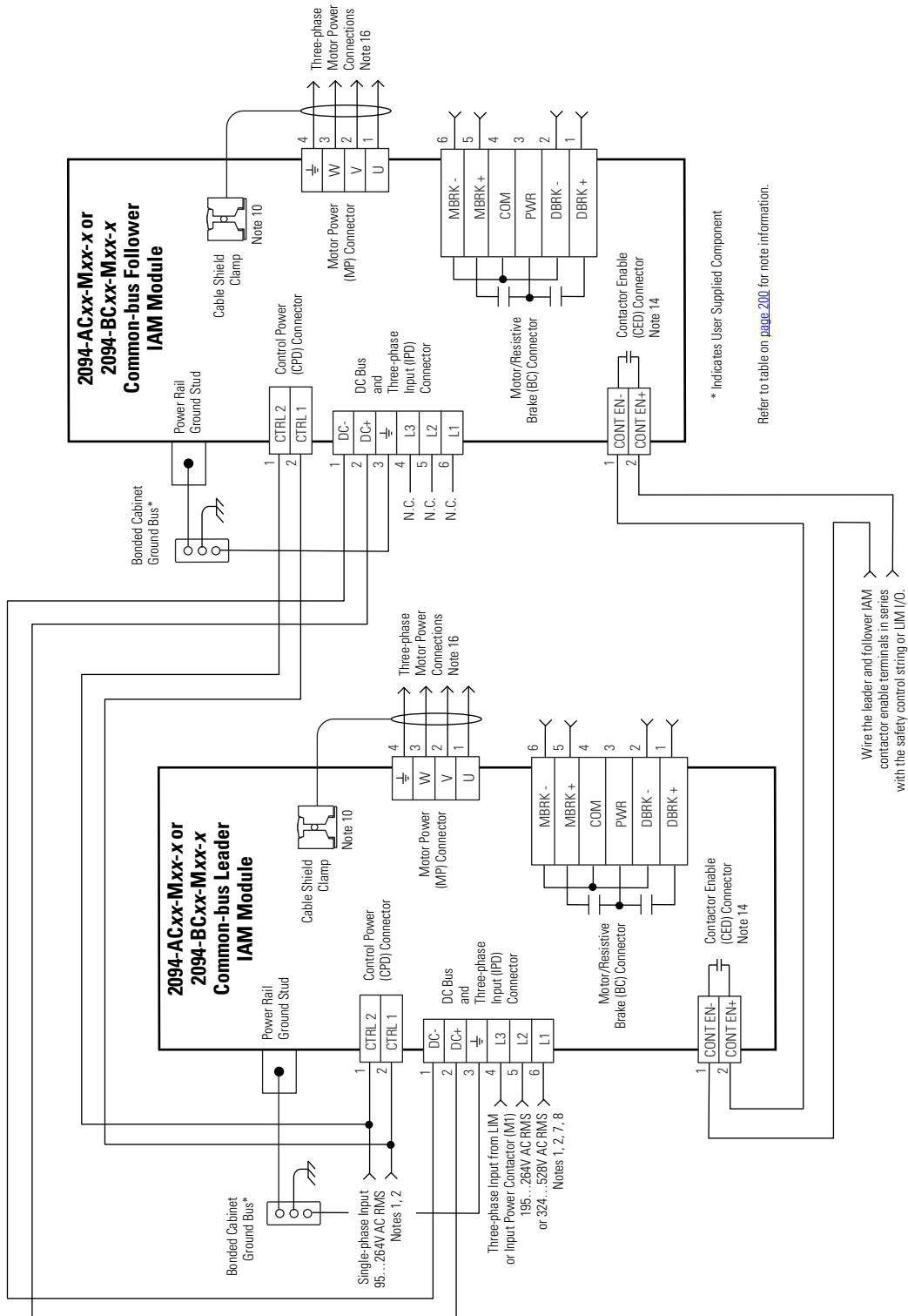
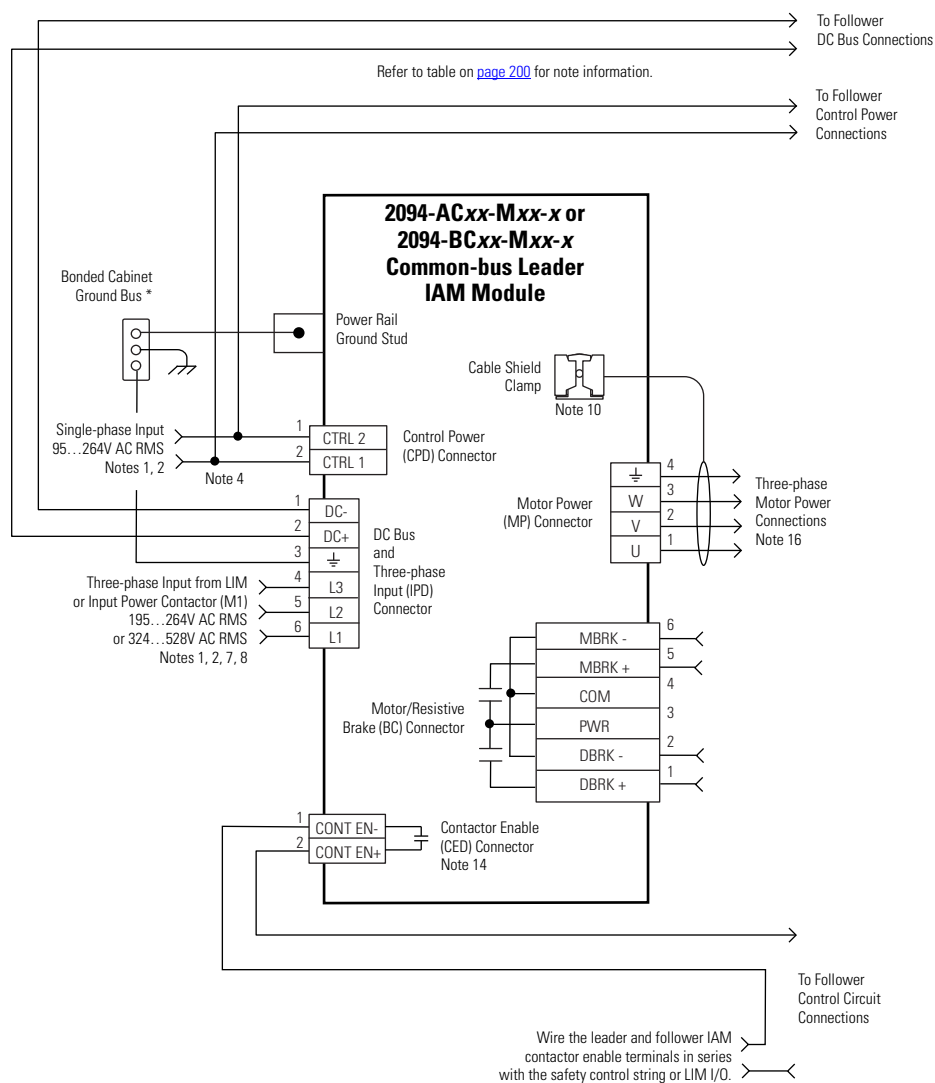


Figure 91
Leader IAM Module with Multiple Follower IAM Modules



Leader IAM Module with Multiple Follower IAM Modules (Continued)

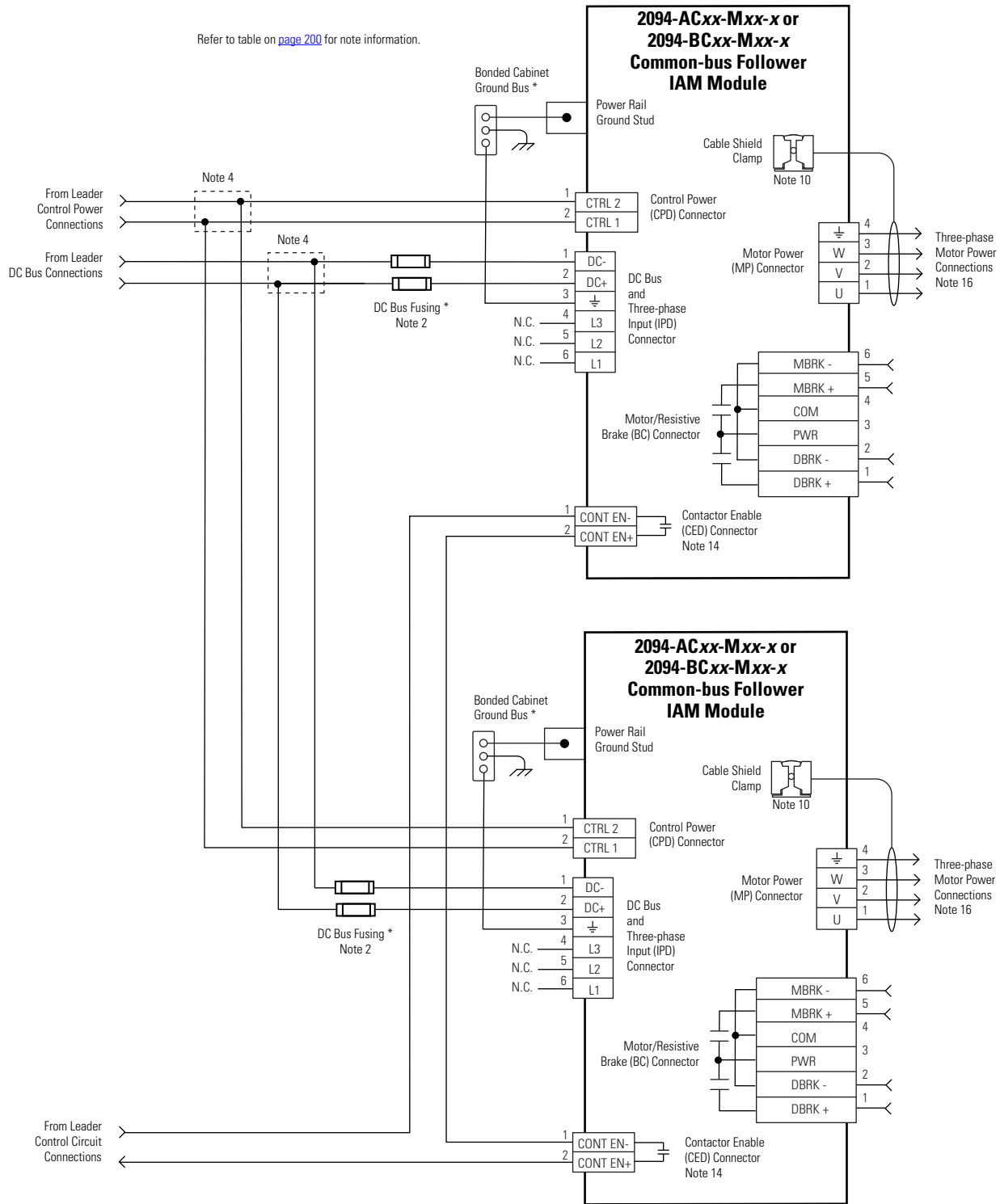
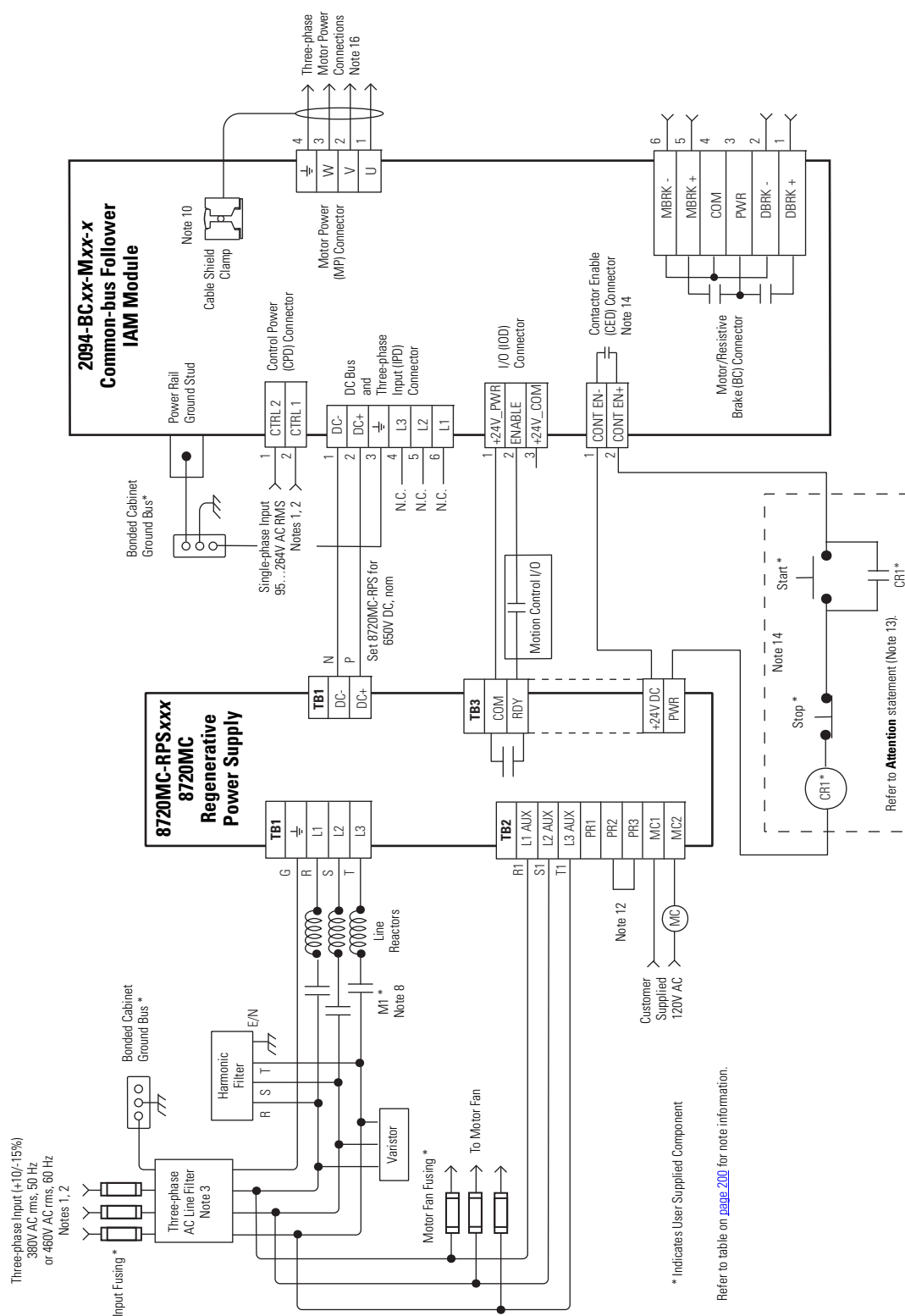


Figure 92
8720MC-RPS Leader Drive with Single Follower IAM Module

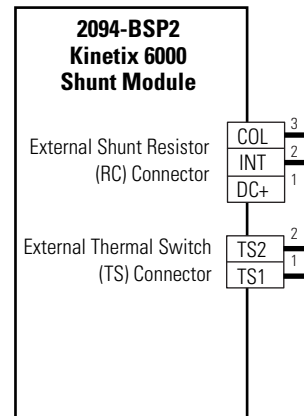


IMPORTANT Use a pushbutton circuit (instead of an SPST toggle switch) in series with the contactor enable string (between the 8720MC-RPS and Kinetix 6000 drive) to allow a drive fault to remove the DC bus power, and to prevent the drive from applying DC bus power without your input after clearing a drive fault.

Shunt Module Wiring Examples

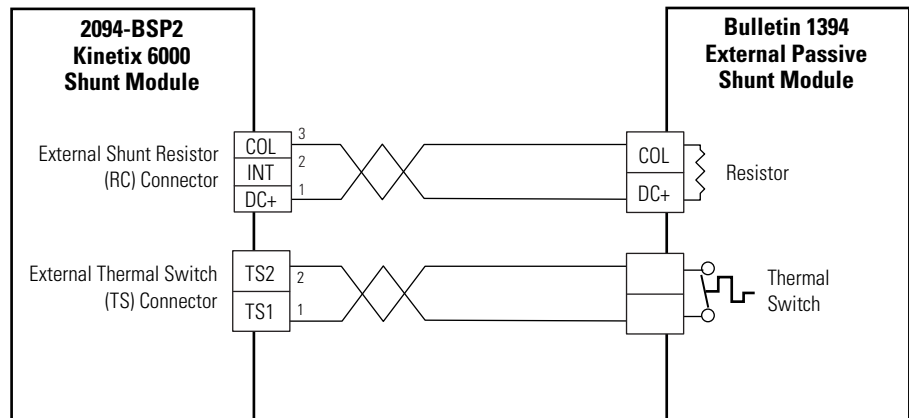
Refer to External Shunt Module Specifications on [page 194](#), for the Bulletin 1394 and Bulletin 1336 external shunt module catalog numbers available for the Kinetix 6000 drive systems.

Figure 93
Shunt Module Wired for Internal Operation (default configuration)



Refer to the Kinetix 6000 Shunt Module Installation Instructions, publication [2094-IN004](#), for additional installation information.

Figure 94
Shunt Module with External Passive Shunt



IMPORTANT Only passive shunts with a thermal switch are wired to the TS connector on the Kinetix 6000 shunt module. If your external passive shunt does not have a thermal switch, leave the jumper (default configuration) in place on the TS connector.

Refer to the External Shunt Module Installation Instructions, publication [2090-IN004](#), for additional installation information.

Figure 95
IAM Module with Single External Chopper Module

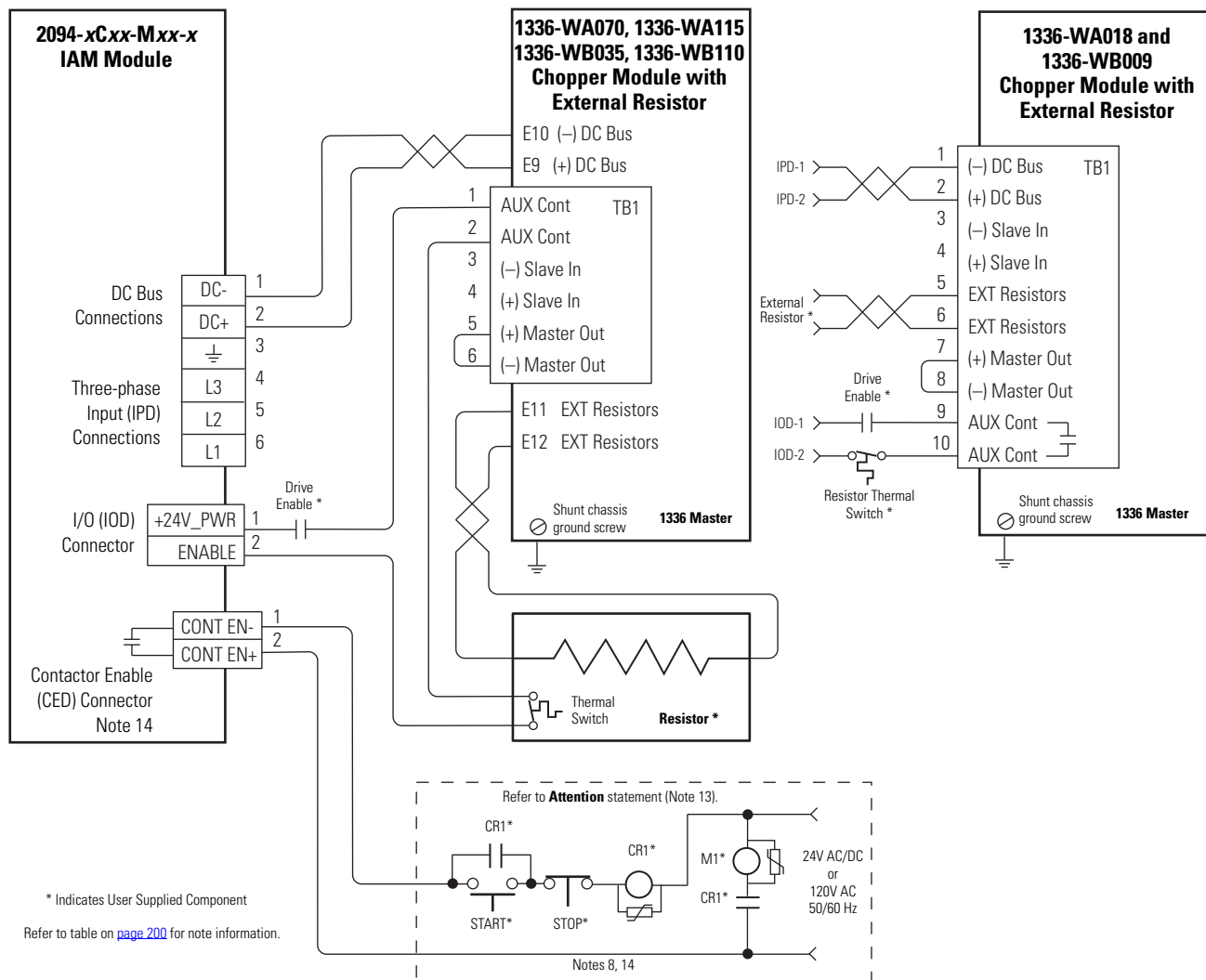
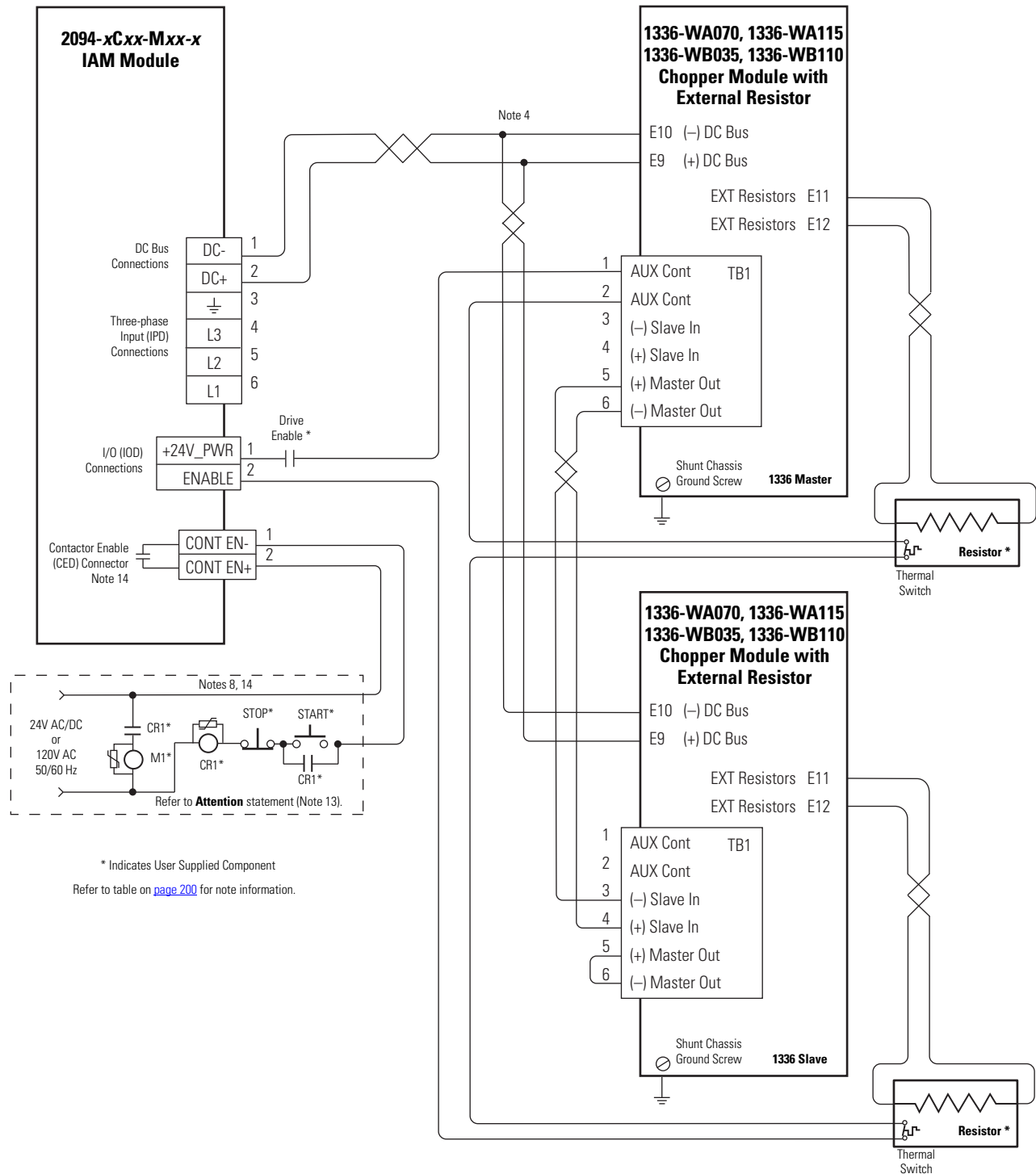


Table 119 - 1336 Chopper Module Fault Relay Specifications

Attribute	Value
Description	Normally-closed contact, TTL compatible, closed when power is applied, open when a brake fault or loss of power occurs.
UL/CSA rating	1.0 A, 125V AC
	1.0 A, 110V AC
	2.0 A, 30V DC
Initial contact resistance	100 m Ω max

Figure 96
IAM Module with Multiple External Chopper Modules

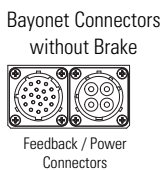
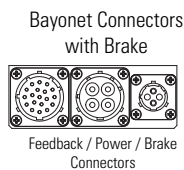
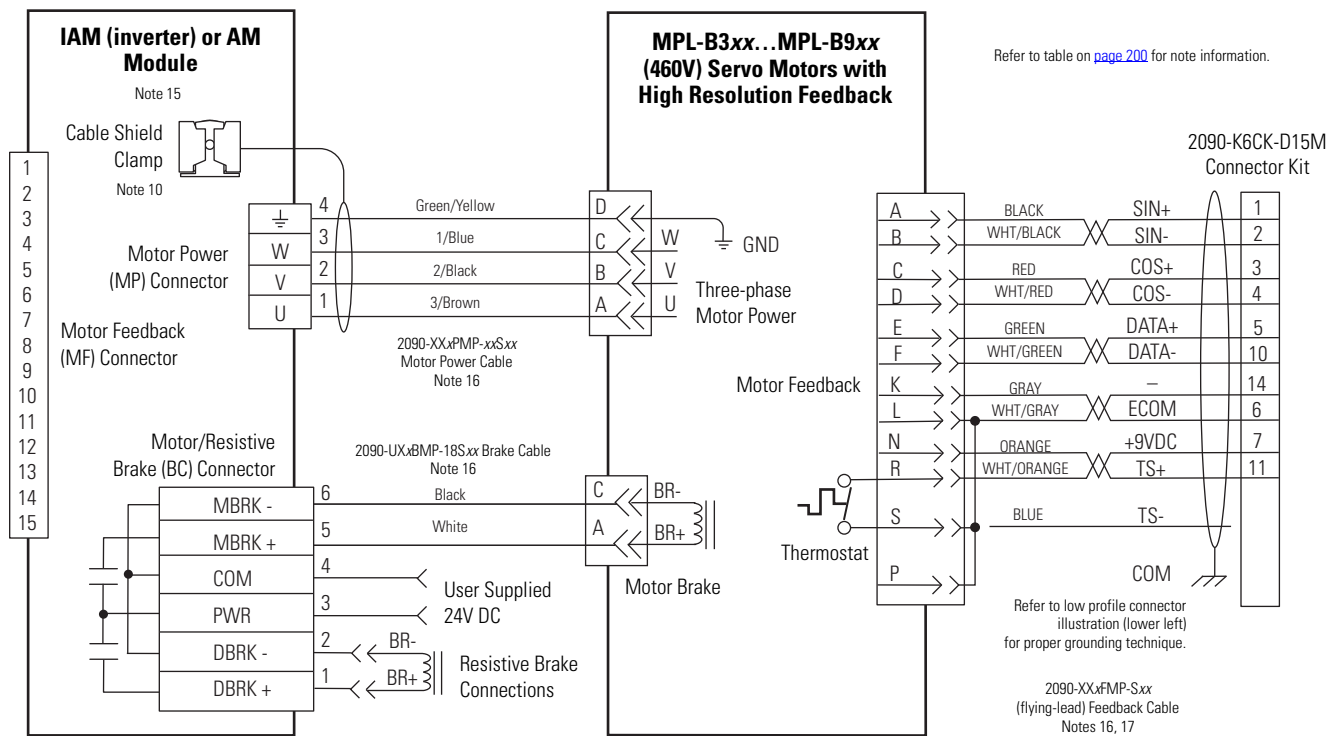


Refer to the 1336 Chopper Module Installation Instructions, publication [1336-5.65](#), for additional installation information.

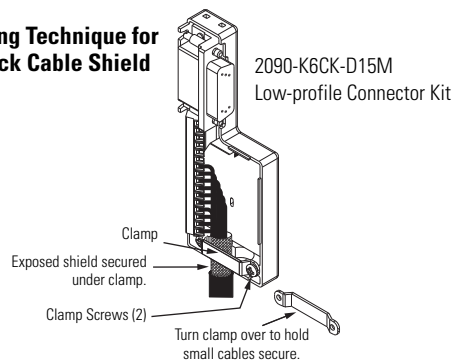
Axis Module/Rotary Motor Wiring Examples

IMPORTANT The Bulletin MPL motor wiring examples on this page apply to motors equipped with bayonet connectors.

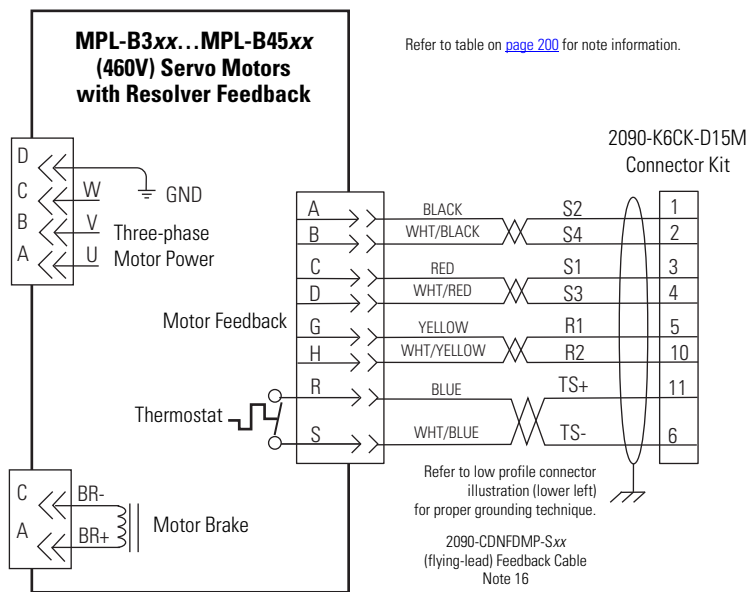
Figure 97
AM Module (460V) with MP-Series (Bulletin MPL-B) Rotary Motors



Grounding Technique for Feedback Cable Shield

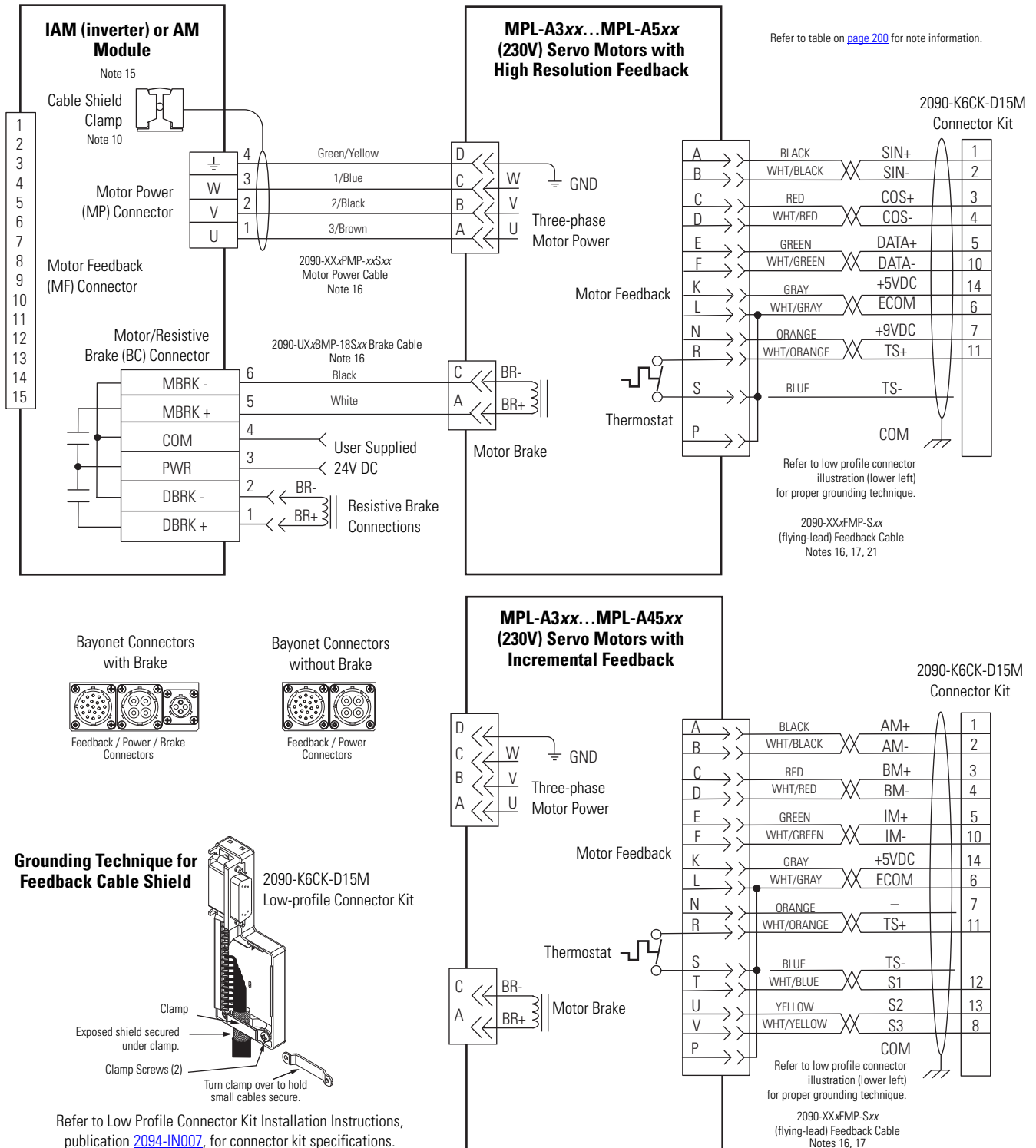


Refer to Low Profile Connector Kit Installation Instructions, publication 2094-IN007, for connector kit specifications.



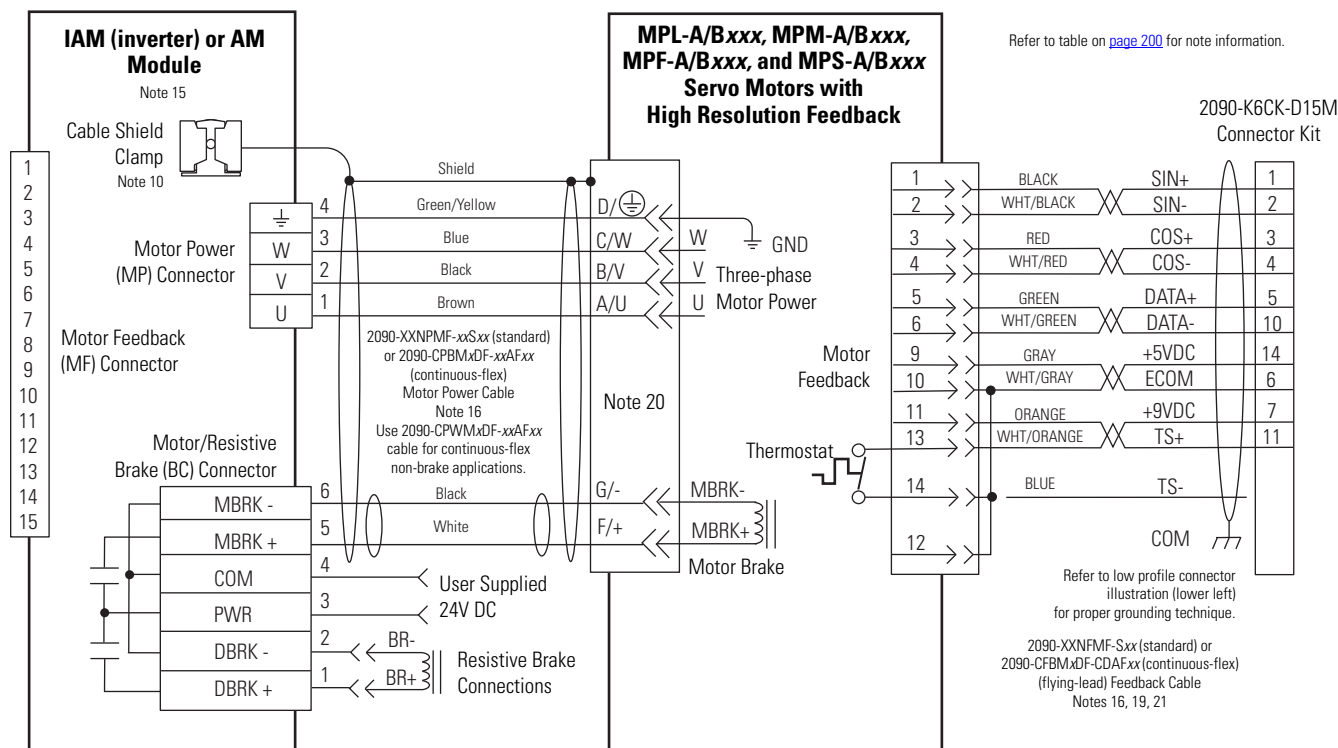
IMPORTANT The Bulletin MPL motor wiring examples on this page apply to motors equipped with bayonet connectors.

Figure 98
AM Module (230V) Wiring Example with
MP-Series (Bulletin MPL-A) Rotary Motors

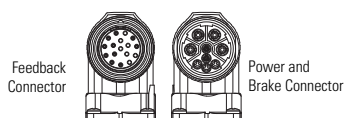


IMPORTANT The Bulletin MPL motor wiring examples on this page apply to motors equipped with circular DIN connectors.

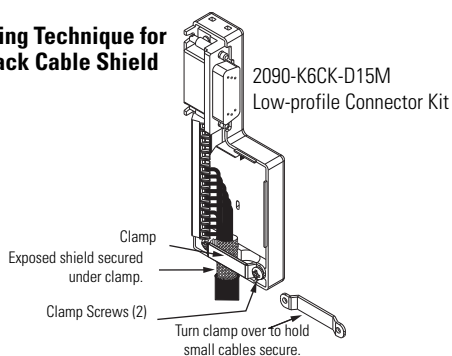
Figure 99
AM Module with MP-Series (Bulletin MPL-A/B, MPM-A/B, MPF-A/B, and MPS-A/B) Motors



Circular DIN Connectors

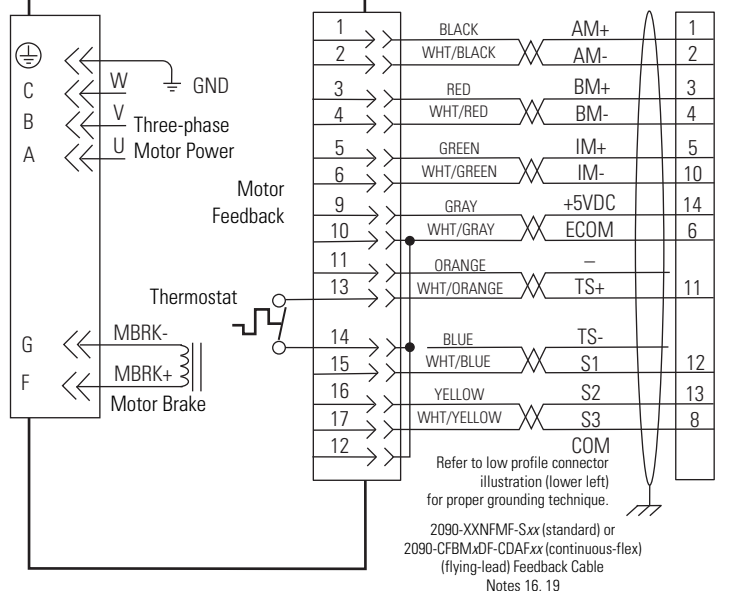


Grounding Technique for Feedback Cable Shield



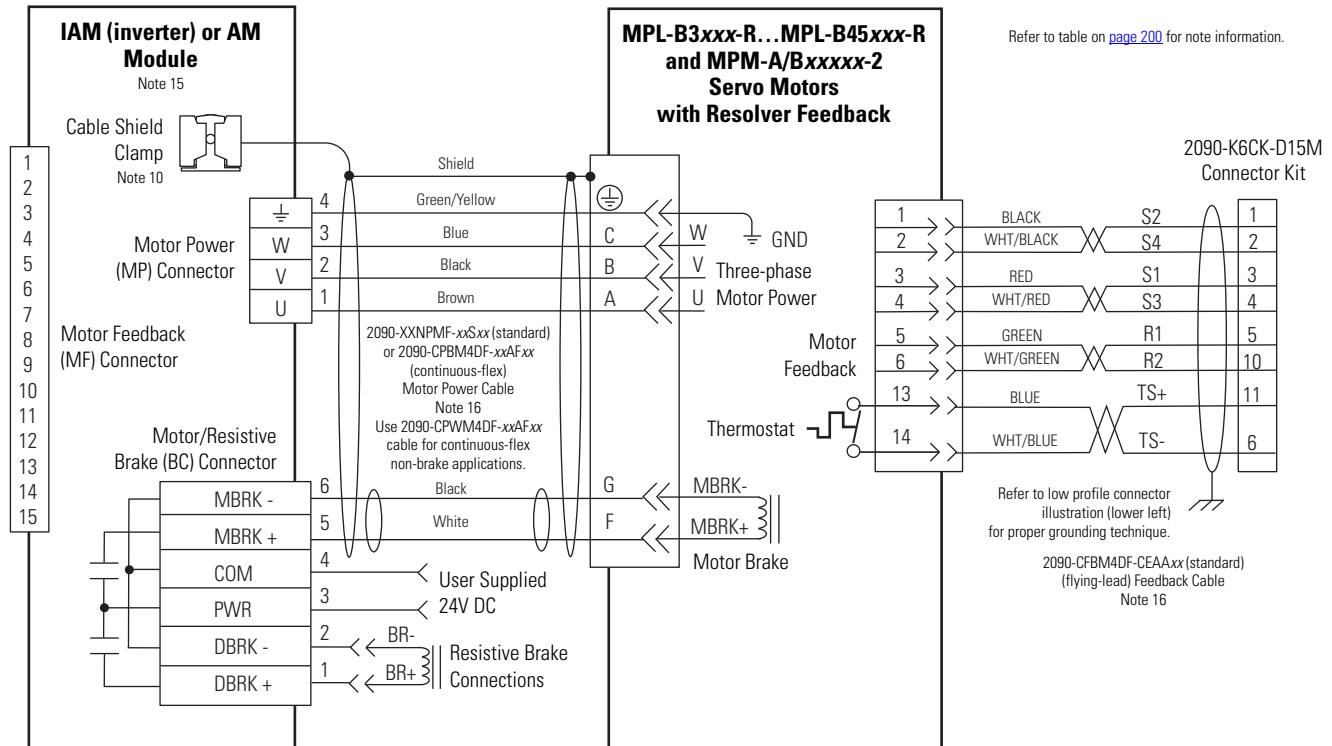
Refer to Low Profile Connector Kit Installation Instructions, publication [2094-IN007](#), for connector kit specifications.

MPL-A/B15xx and MPL-A/B2xx MPL-A3xx...MPL-A45xx Servo Motors with Incremental Feedback

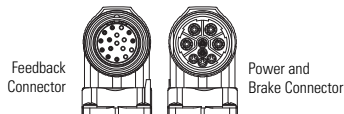


IMPORTANT The Bulletin MPL motor wiring examples on this page apply to motors equipped with circular DIN connectors.

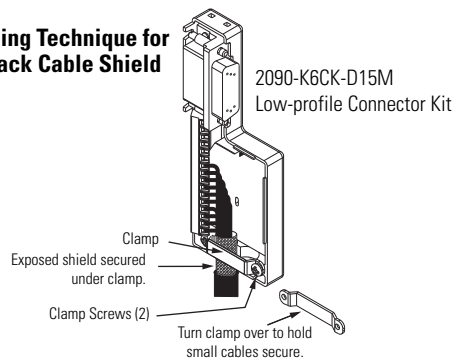
Figure 100
AM Module Wiring Example with
MP-Series (Bulletin MPL-B and MPM-A/B resolver) Motors



Circular DIN Connectors

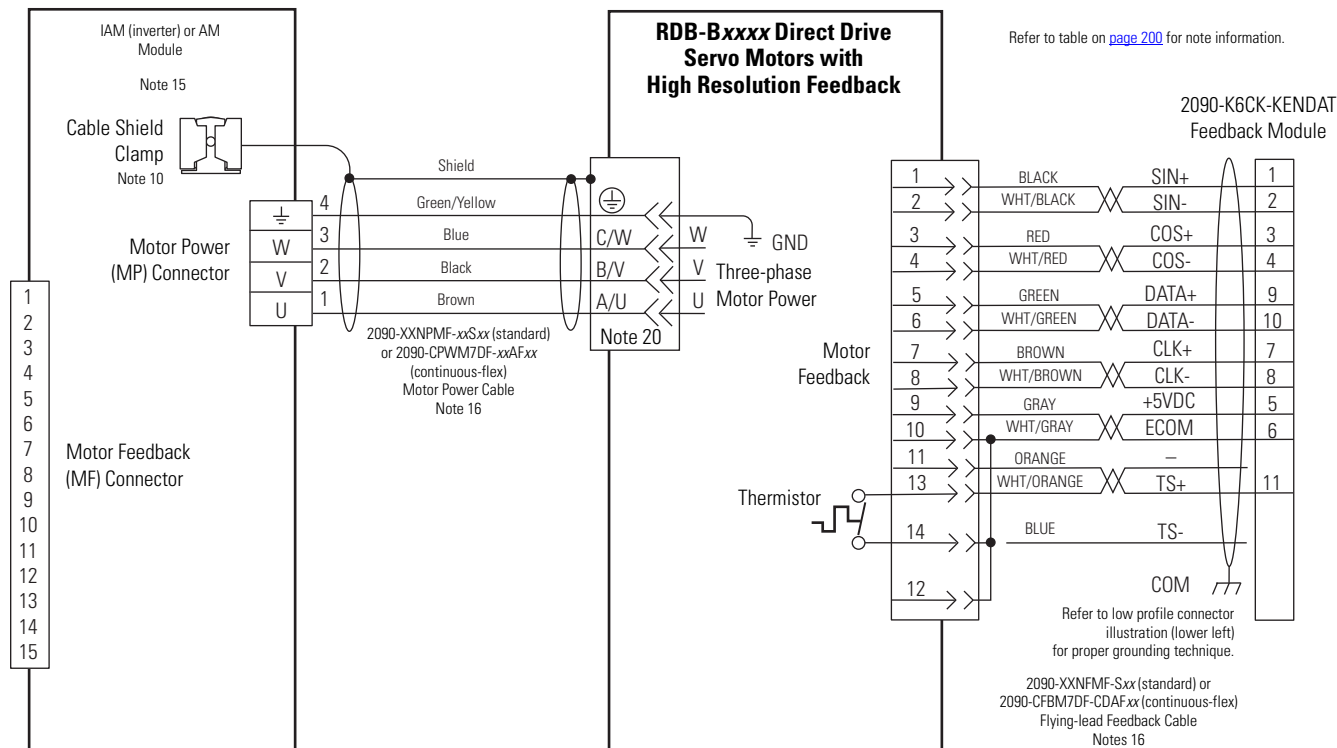


Grounding Technique for Feedback Cable Shield

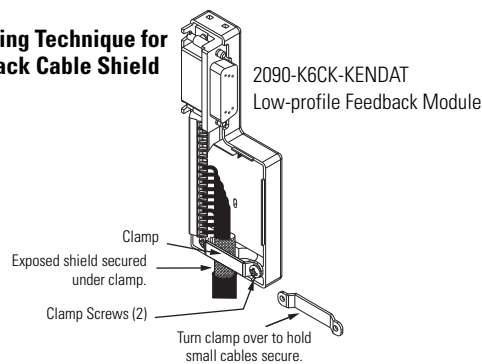


Refer to Low Profile Connector Kit Installation Instructions, publication [2094-IN007](#), for connector kit specifications.

Figure 101 - AM Module with RDD-Series Direct Drive Motors

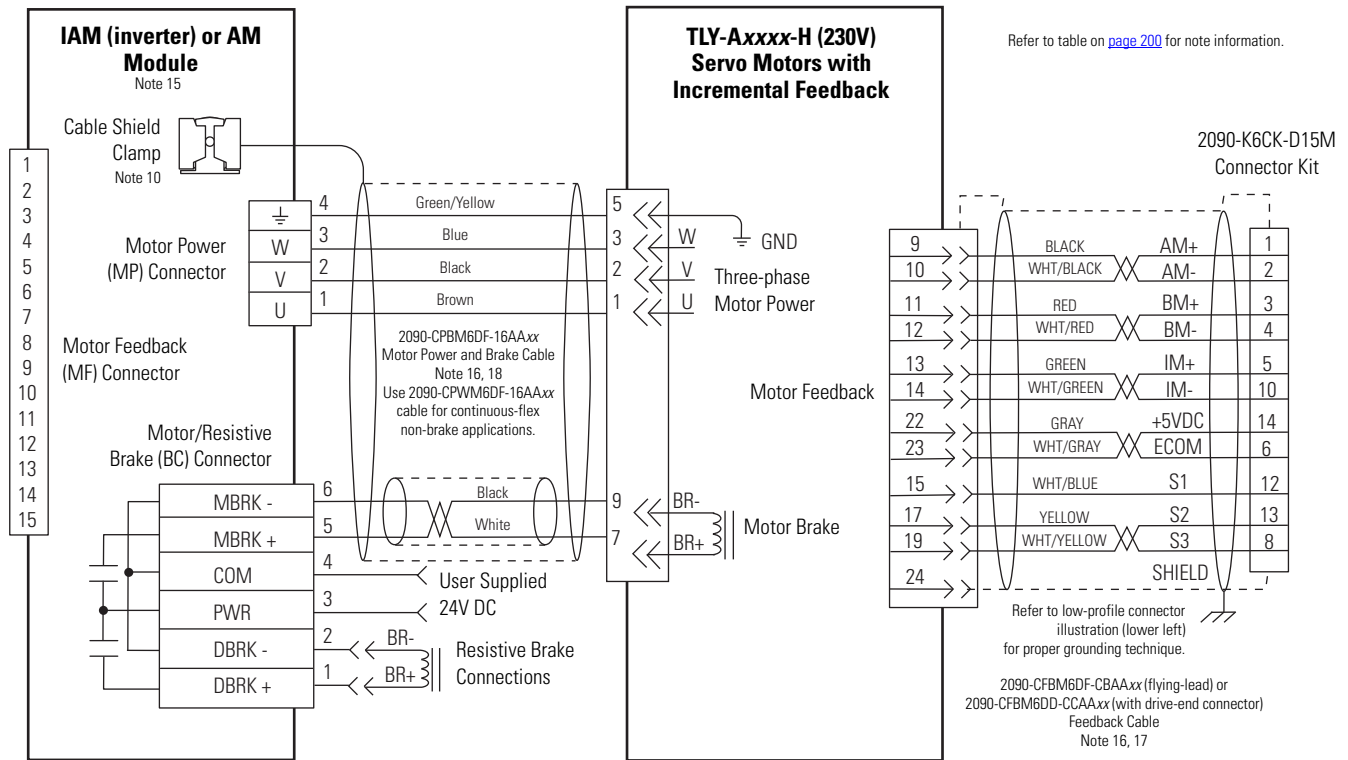


Grounding Technique for Feedback Cable Shield

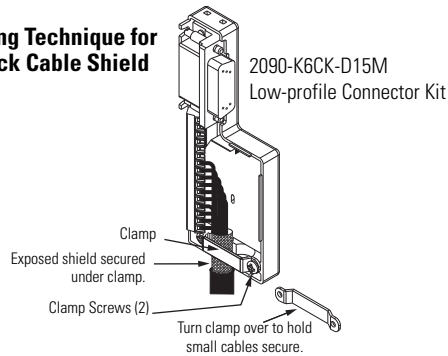


Refer to Low Profile EnDat Feedback Module Installation Instructions, publication [2090-IN020](#), for connector kit specifications.

Figure 102
AM Module (230V) Wiring Example with TL-Series (Bulletin TLY-A) Motors

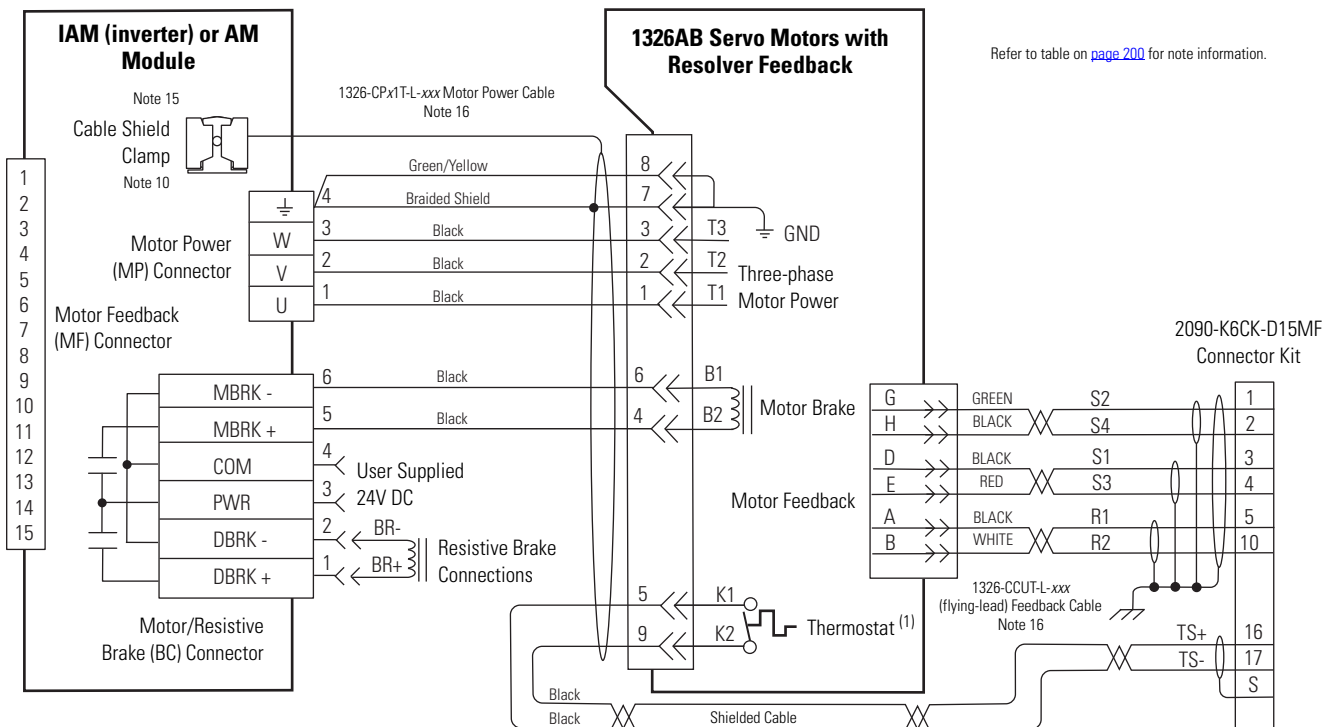
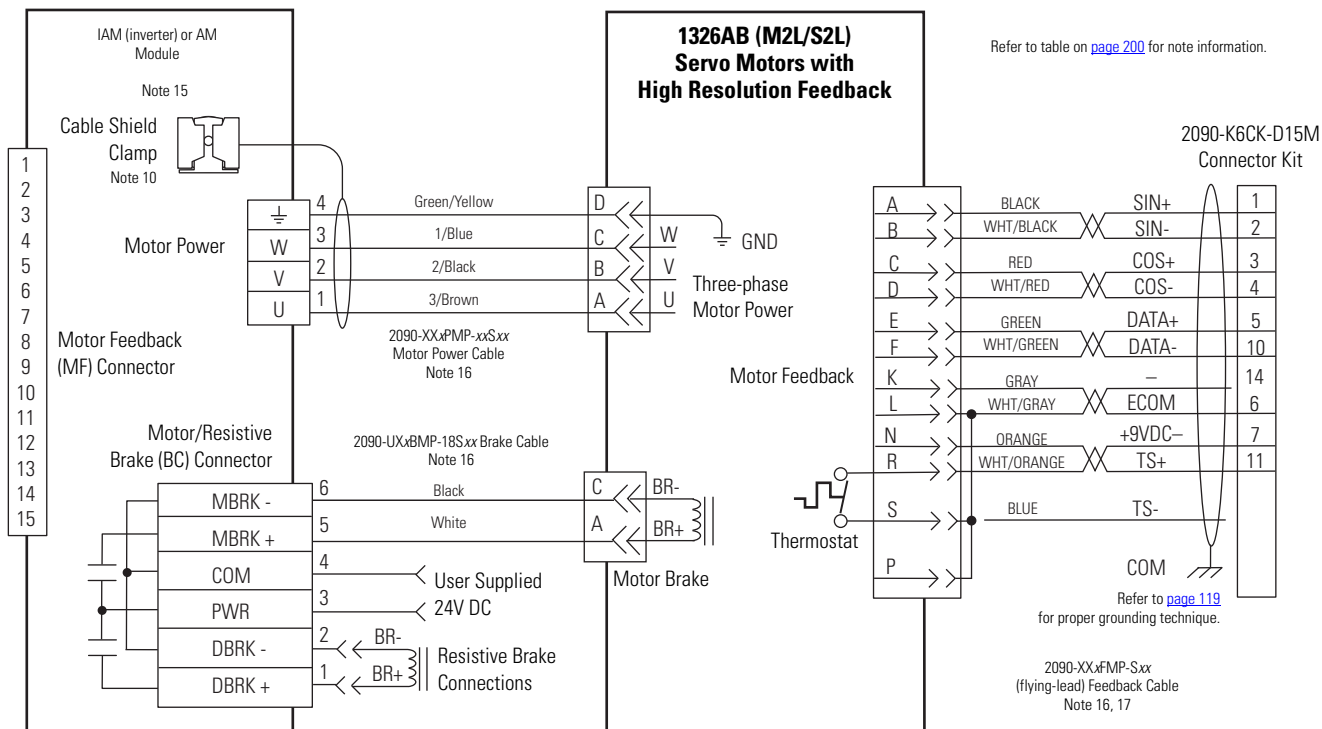


Grounding Technique for Feedback Cable Shield



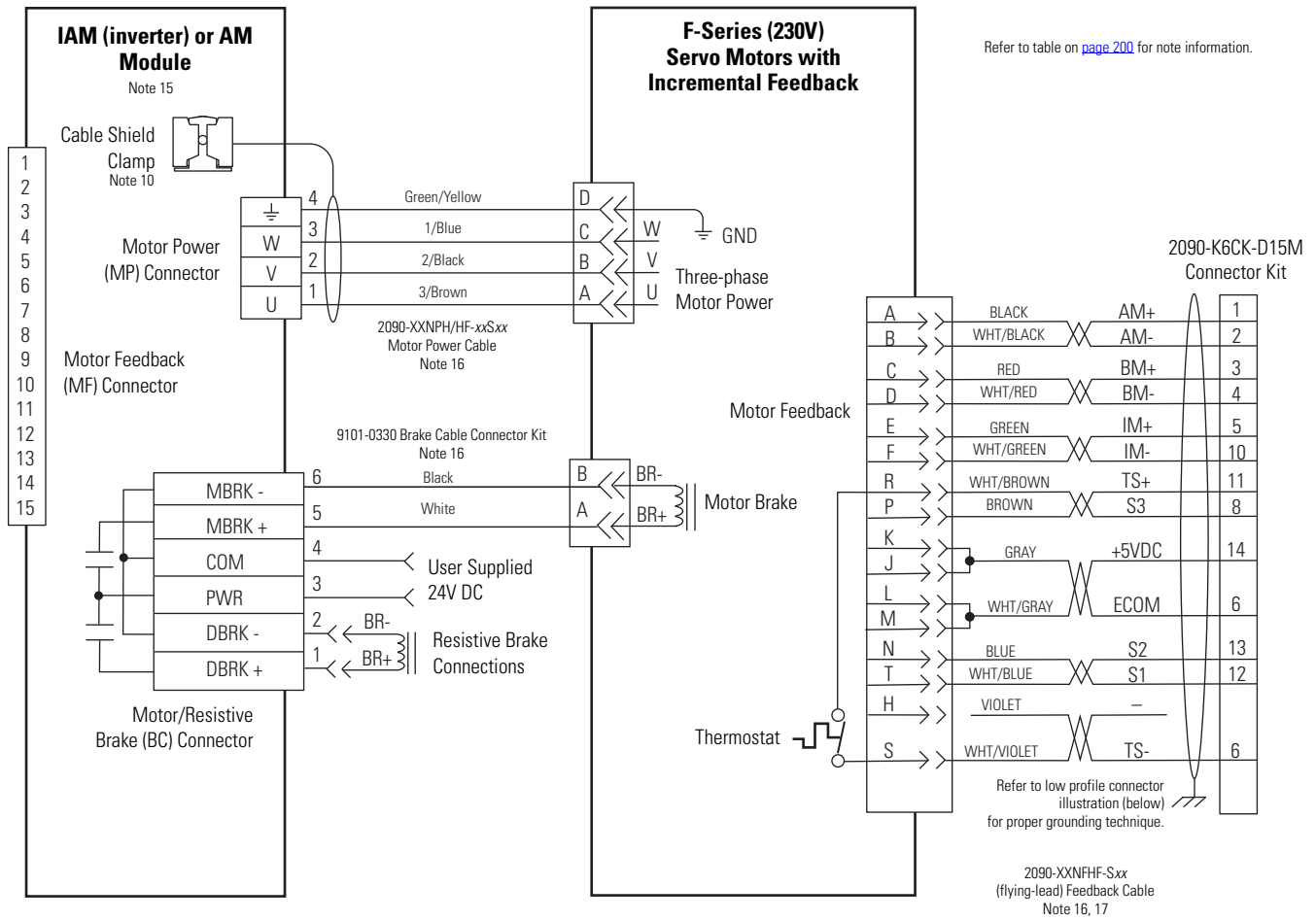
Refer to Low Profile Connector Kit Installation Instructions, publication [2094-IN007](#), for connector kit specifications.

Figure 103 AM Module (460V) Wiring Examples with 1326AB Motors

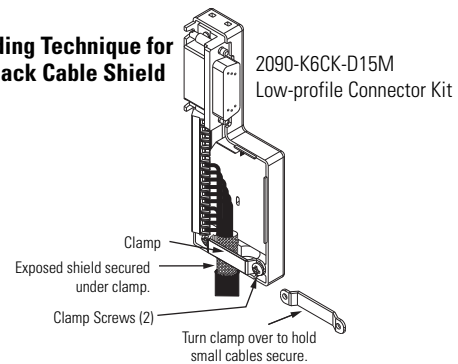


- (1) When wiring the thermal switch on 1326AB (resolver-based) motors requires the use of the 2090-K6CK-D15MF Low-profile connector kit and wire extension to the power connector. Pins 16, 17, and S are filtered to prevent noise transmission back to the drive. Refer to [page 119](#) for wiring instructions and a diagram.

Figure 104
AM Module (230V) Wiring Example with F-Series Motors



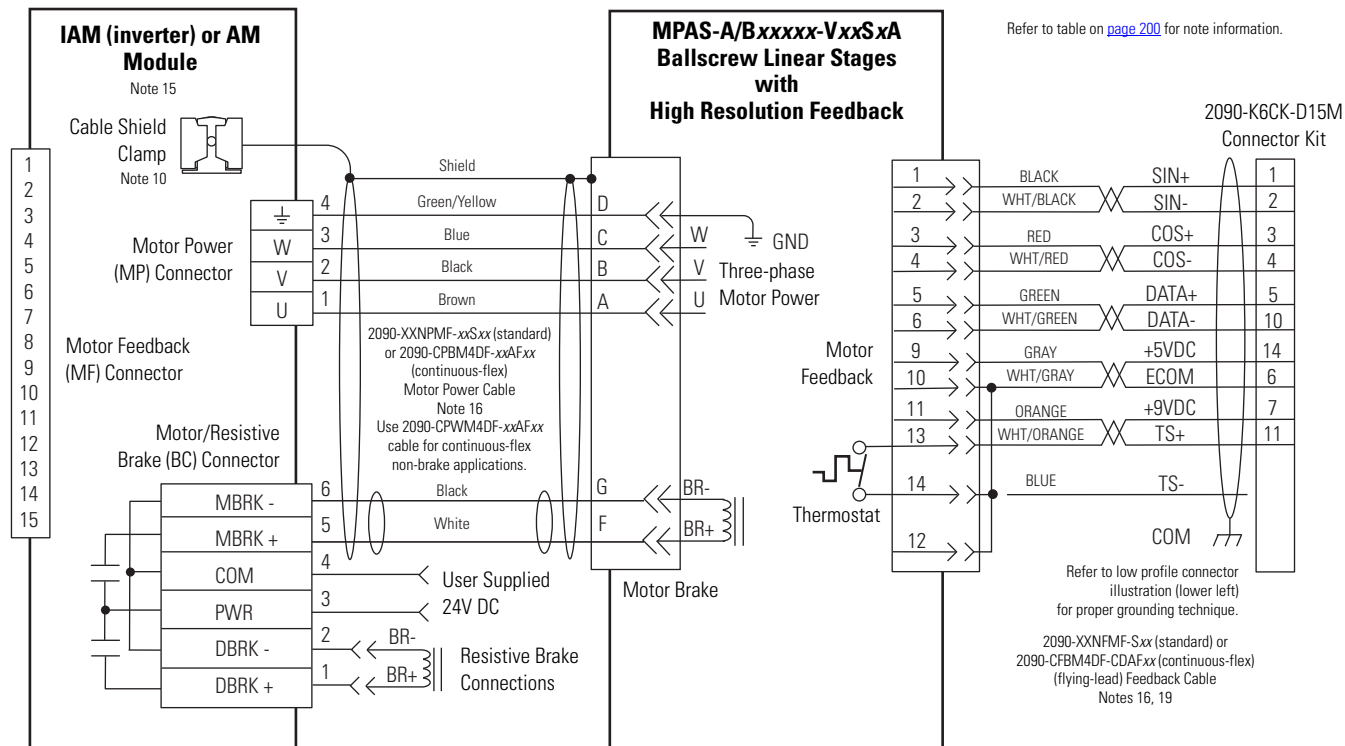
Grounding Technique for Feedback Cable Shield



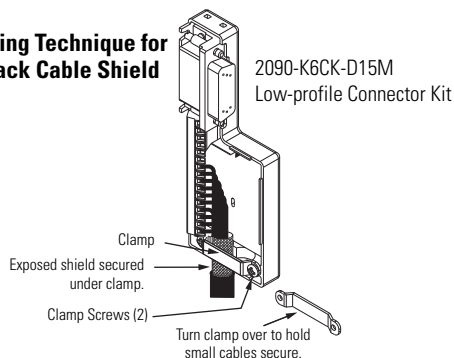
Refer to Low Profile Connector Kit Installation Instructions, publication [2094-IN007](#), for connector kit specifications.

Axis Module/Linear Motor/Actuator Wiring Examples

Figure 105
AM Module with MP-Series Integrated Linear Stages



Grounding Technique for Feedback Cable Shield



Refer to Low Profile Connector Kit Installation Instructions, publication [2094-IN007](#), for connector kit specifications.

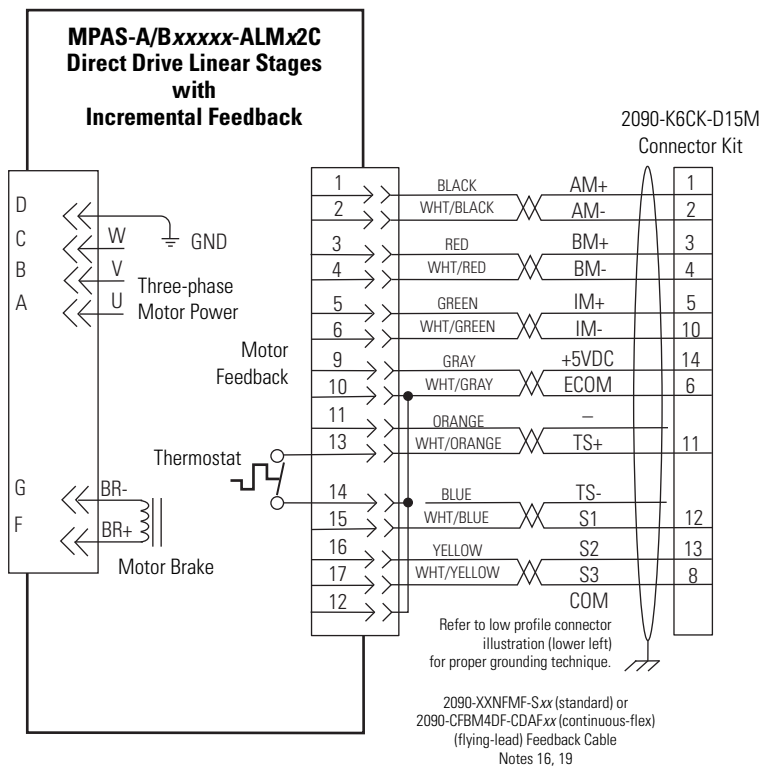
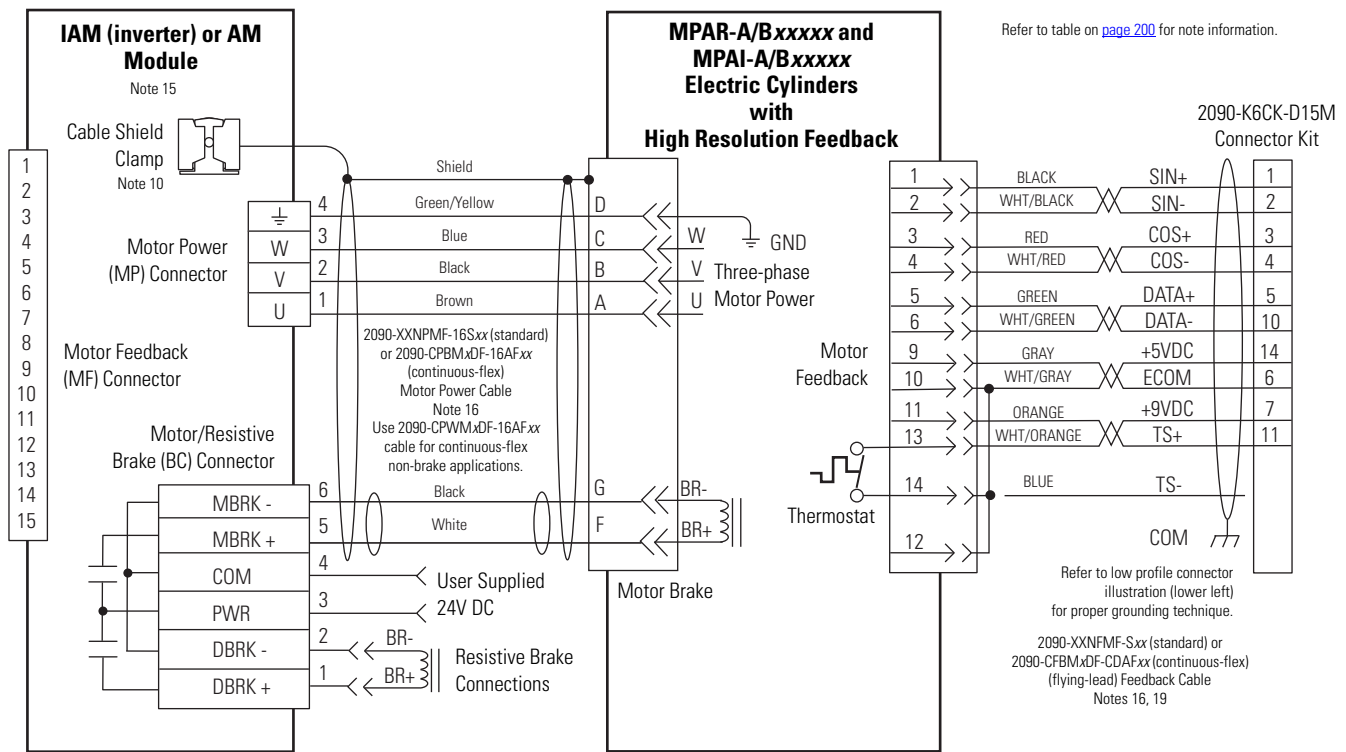
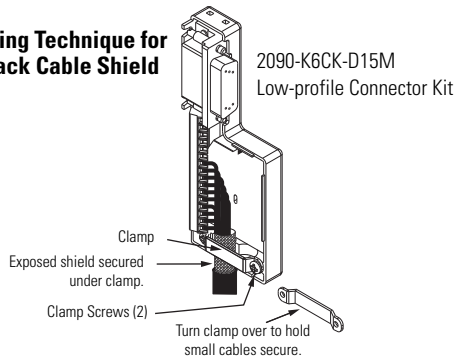


Figure 106
AM Module with MP-Series Electric Cylinders



Grounding Technique for Feedback Cable Shield

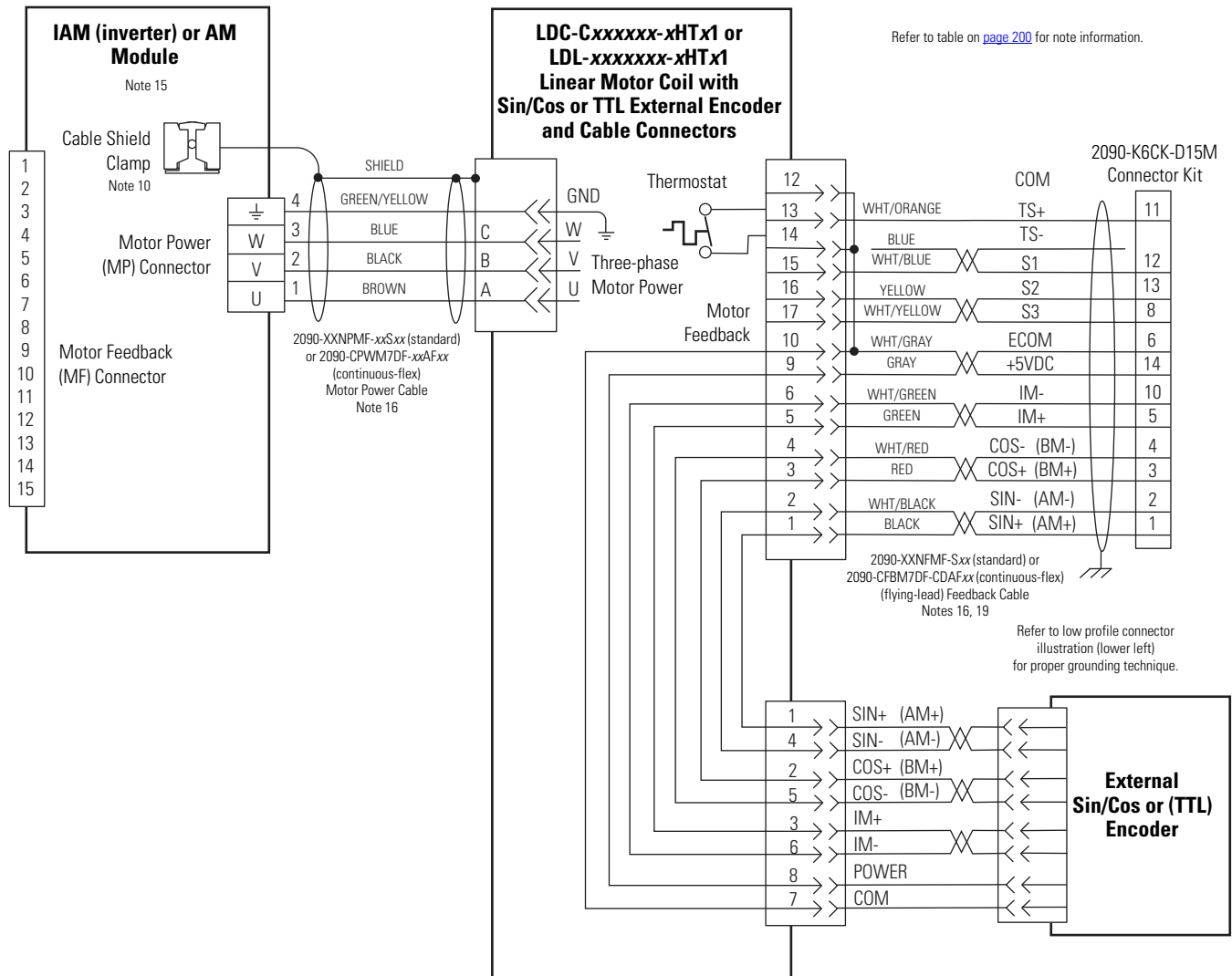


Refer to Low Profile Connector Kit Installation Instructions, publication [2094-IN007](#), for connector kit specifications.

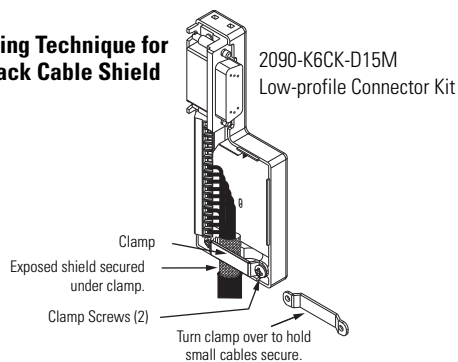
Table 120 - MP-Series Electric Cylinder Power and Feedback Cables

MP-Series Electric Cylinder Cat. No.	Frame	Power Cable Cat. No.	Feedback Cable Cat. No.
MPAR-A/B1xxx	32	2090-CPxM4DF-16AFxx	2090-XXNFMF-Sxx (standard) 2090-CFxM4DF-16AFxx (continuous-flex)
MPAR-A/B2xxx	40		
MPAR-A/B3xxx	63	2090-CPxM7DF-16AFxx	2090-XXNFMF-Sxx (standard) 2090-CFxM7DF-16AFxx (continuous-flex)
MPAI-A/Bxxxxx	83		
	110		

Figure 107
AM Module with LDC-Series or LDL-Series Linear Motors with Cable Connectors

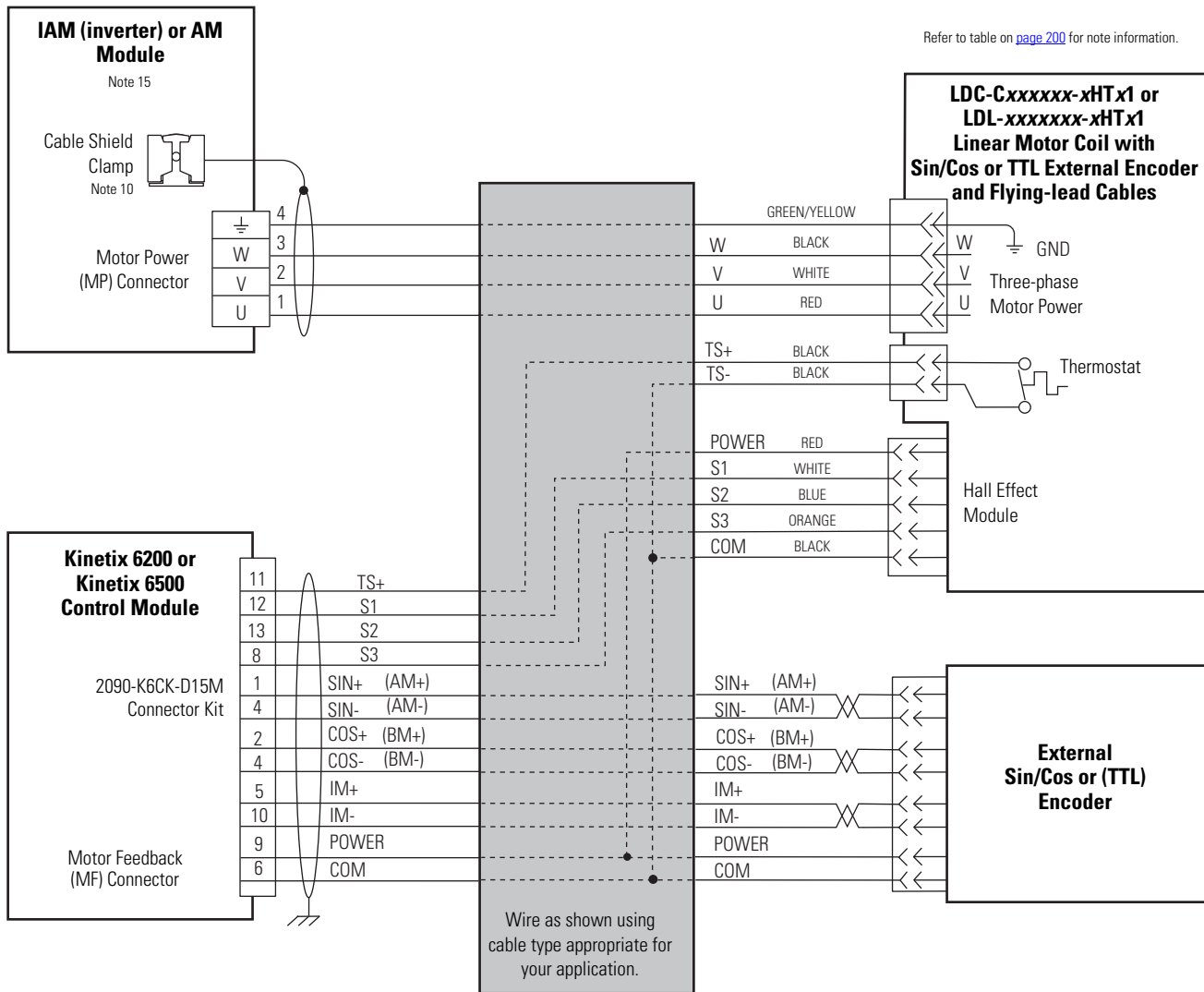


Grounding Technique for Feedback Cable Shield

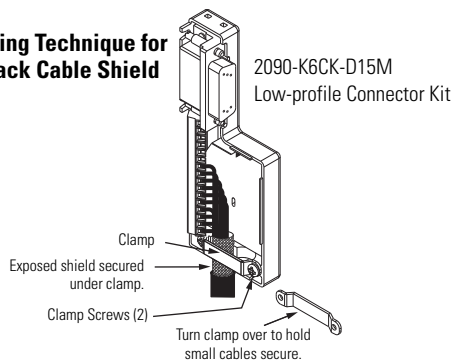


Refer to Low Profile Connector Kit Installation Instructions, publication [2094-IN007](#), for connector kit specifications.

Figure 108
AM Module with LDC-Series or LDL-Series Linear Motors with Flying-lead Cables



Grounding Technique for Feedback Cable Shield



Refer to Low Profile Connector Kit Installation Instructions, publication [2094-IN007](#), for connector kit specifications.

Controlling a Brake Example

The relay output of the Kinetix 6000 (MBRK± BC-5 and BC-6) is suitable for directly controlling a motor brake, subject to the relay voltage limit of 30V DC, and the relay current limit as shown below.

Table 121 - Brake Relay Current Limit

Kinetix 6000 IAM/AM Module	Brake Current Rating, max	
	Series A Drives	Series B Drives
2094-AC05-Mxx-x, 2094-AC09-M02-x, 2094-AMP5-x, 2094-AM01-x, 2094-AM02-x	1.0 A	N/A
2094-BC01-Mxx-x, 2094-BC02-M02-x, 2094-BMP5-x, 2094-BM01-x, 2094-BM02-x	1.0 A	3.0 A
2094-AC16-M03-x, 2094-AC32-M05-x, 2094-AM03-x, 2094-AM05-x	1.3 A	N/A
2094-BC04-M03-x, 2094-BC07-M05-x, 2094-BM03-x, 2094-BM05-x	3.0 A	3.0 A

Table 122 - Coil Currents Rated at < 1.0 A

Compatible Brake Motors/Actuators ⁽¹⁾	Coil Current	Compatible Brake Motors	Coil Current
MPL-x1510, MPL-x1520, MPL-x1530	0.43...0.53 A	TLY-A110T-H, TLY-A120T-H, and TLY-A130T-H	0.18...0.22 A
MPL-x210, MPL-x220, MPL-x230	0.46...0.56 A	TLY-A220T-H and TLY-A230T-H	0.333...0.407 A
MPL/MPF-x310, MPL/MPF-x320, MPL/MPF-x330	0.45...0.55 A	TLY-A2530P-H, TLY-A2540P-H, and TLY-A310M-H	0.351...0.429 A
MPS-x330, MPM-x115		1326AB-B4xxx	0.88 A
MPL-x420, MPL-x430, MPL-x4520, MPL-x4530, MPL-x4540, MPL-x4560	0.576...0.704 A	F-4030, F-4050, and F-4075	0.69 A
MPF-x430, MPF-x4530, MPF-x4540			
MPS-x4540, MPM-x130			

Table 123 - Coil Currents Rated at >1.0 A and ≤1.3 A

Compatible Brake Motors ⁽¹⁾	Coil Current	Compatible Brake Motors	Coil Current
MPL-xB520, MPL-xB540, MPL-x560, MPL-x580	1.05...1.28 A	F-6100, F-6200, and F-6300	1.30 A
MPF-x540, MPS-B560, MPM-x165		1326AB-B5xxx, and 1326AB-B7xxx	1.20 A

(1) Use of the variable x indicates this specification applies to 230V and 460V motors.

Table 124 - Coil Currents Rated at >1.3 A and ≤3.0 A

Compatible Brake Motors	Coil Current
MPL-B640, MPL-B660, MPL-B680	1.91...2.19 A
MPL-B860, MPL-B880	2.05...2.50 A
MPM-x215	1.84...2.25 A
MPL-B960, MPL-B980	N/A

IMPORTANT Because the coil current for MPL-B960 and MPL-B980 motors is rated 3.85...4.70 A, an external relay must be used.

System Block Diagrams

This section provides block diagrams of the Kinetix 6000 drive modules. For block diagrams of the LIM module and RBM module, refer to Additional Resources on [page 12](#) for the documentation available for those products.

Figure 109
IAM/AM Module (inverter) Block Diagram

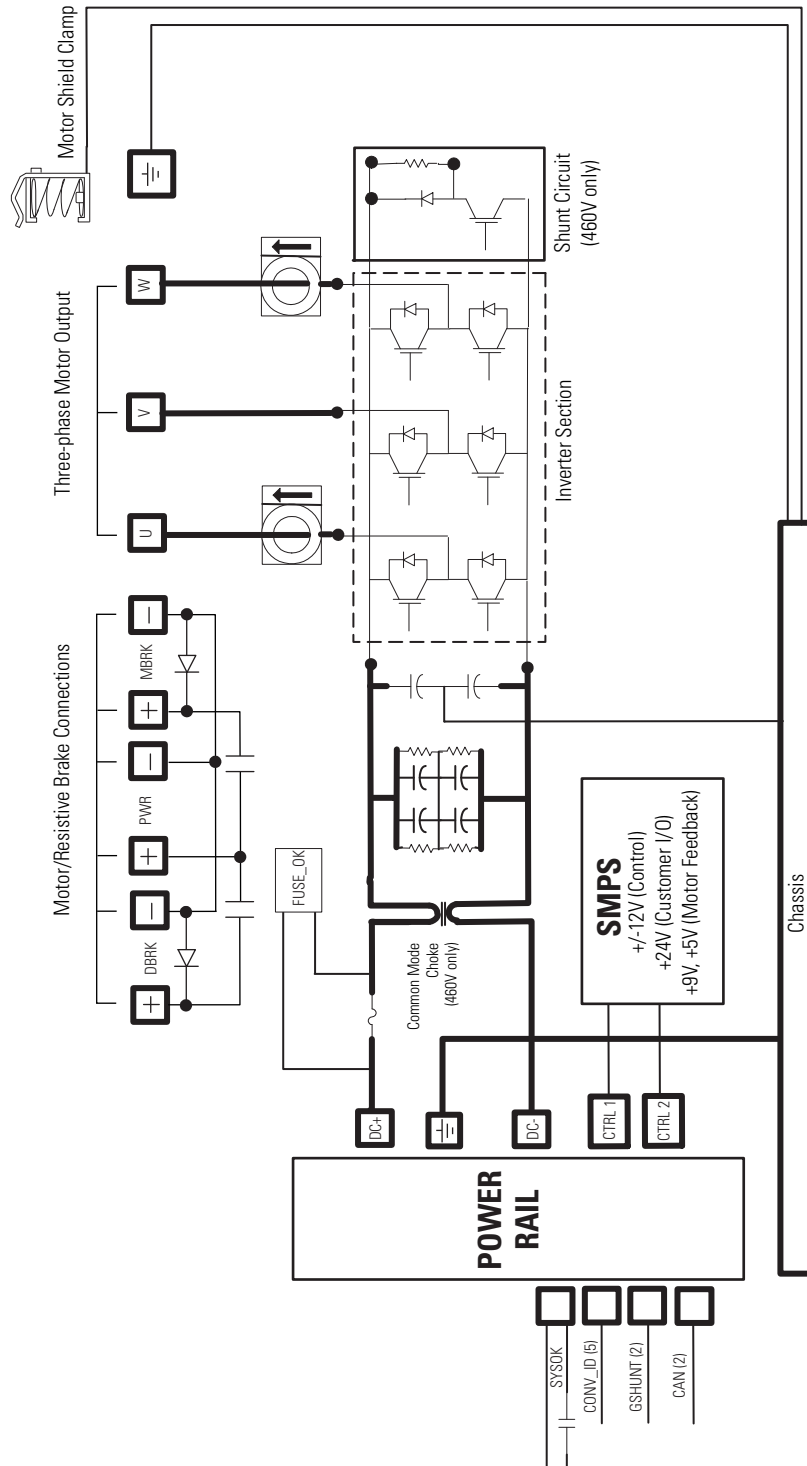
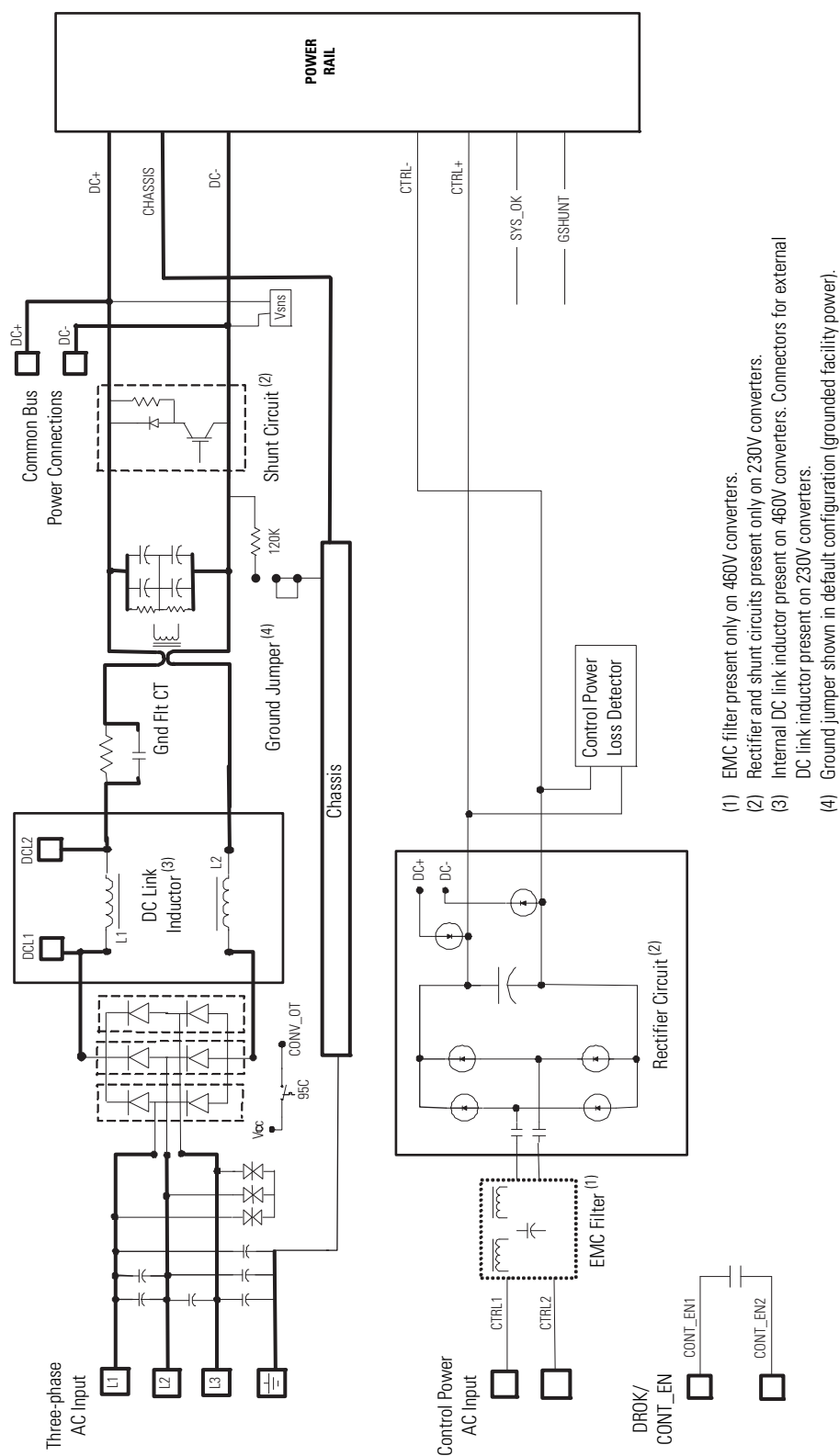


Figure 110
IAM Module (converter) Block Diagram



Kinetix 6000 drives with the safe-off speed monitoring feature ships with the wiring header and motion-allowed jumper installed. In this configuration, the safe-off feature is not used.

Figure 111
Safe-off Feature Block Diagram

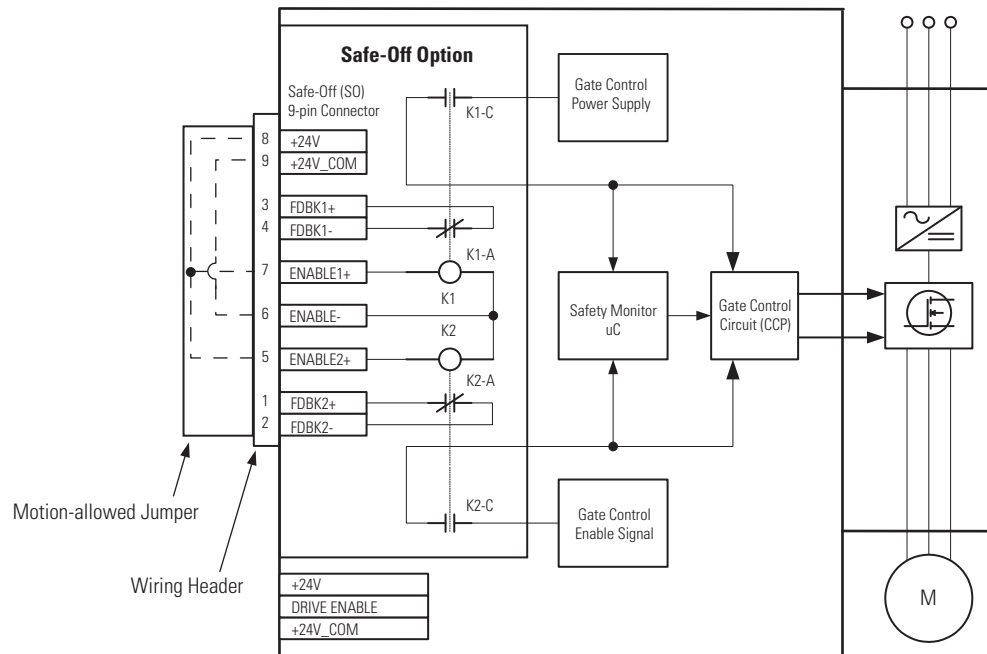
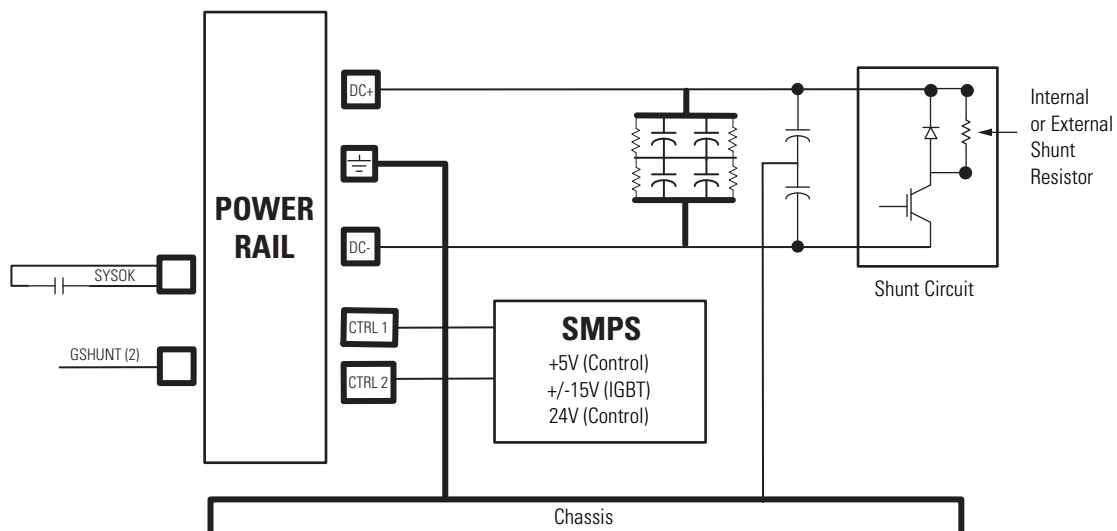


Figure 112
Shunt Module Block Diagram



Notes:

Upgrading the Kinetix 6000 Drive Firmware

Introduction

This appendix provides procedures for upgrading firmware by using either ControlFLASH or DriveExplorer software.

Topic	Page
Introduction	229
Upgrade Drive Firmware with ControlFLASH Software	230
Upgrade Drive Firmware with DriveExplorer Software	238

Upgrade Drive Firmware with ControlFLASH Software

Upgrading axis module firmware by using ControlFLASH software involves configuring your Logix communication, selecting the drive to flash, and flashing the firmware.

Before You Begin

You need the following software and information before you begin.

Description	Cat. No.	Firmware Revision
RSLogix 5000 software	9324-RLD300NE	15.x or later
ControlLogix SERCOS module	1756-MxxSE	15.32 or later
	1756-L60M03SE	15.4 or later
CompactLogix SERCOS module	1768-M04SE	15.35 or later
SoftLogix SERCOS PCI card	1784-PM16SE	15.33 or later
RSLinx software		2.50 or later
ControlFLASH software kit ⁽¹⁾		4.00.09 or later
Catalog number of the targeted IAM/AM module you want to flash		
Network path to the targeted IAM/AM module.		

(1) Download the ControlFLASH kit from <http://support.rockwellautomation.com/controlflash>. Contact Rockwell Automation Technical Support at (440) 646-5800 for assistance.

For more ControlFLASH information (not drive specific), refer to the ControlFLASH Firmware Upgrade Kit Quick Start, publication [1756-QS105](#).

IMPORTANT

Control power must be present at CPD-1 and CPD-2 prior to flashing your target drive.

The seven-segment status indicator on the target IAM (inverter) module or AM module must be displaying a fixed 2, 3, or 4 before beginning this procedure.



ATTENTION: To avoid personal injury or damage to equipment during the firmware upgrade due to unpredictable motor activity, do not apply three-phase AC or common-bus DC input power to the drive.

Configure Logix Communication

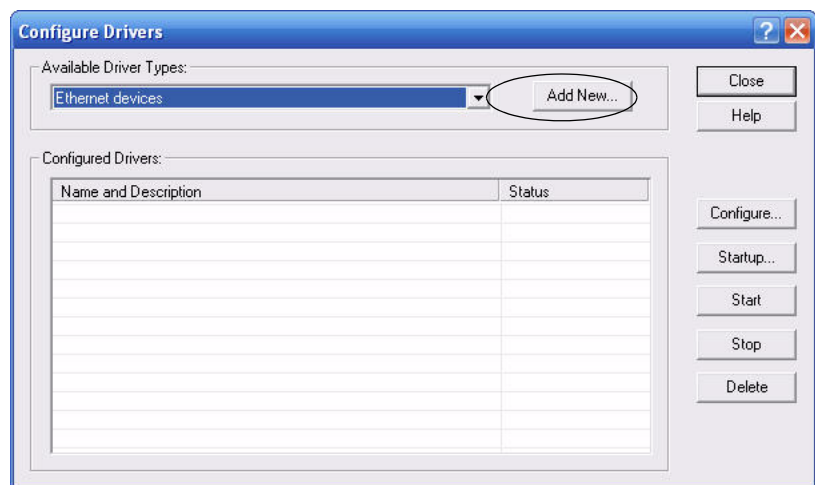
This procedure assumes that your communication method to the Logix controller is using the Ethernet protocol. It is also assumed that your Logix Ethernet module has already been configured.

For more information, refer to the ControlLogix System User Manual, publication [1756-UM001](#).

Follow these steps to configure Logix communication.

1. Open your RSLinx Classic software.
2. From the Communications pull-down menu, choose Configure Drivers.

The Configure Drivers dialog box opens.



3. From the Available Drive Types pull-down menu, choose Ethernet devices.
4. Click Add New.

The Add New RSLinx Classic Driver dialog box opens.

5. Type the new driver name.



6. Click OK.

The Configure driver dialog box opens.

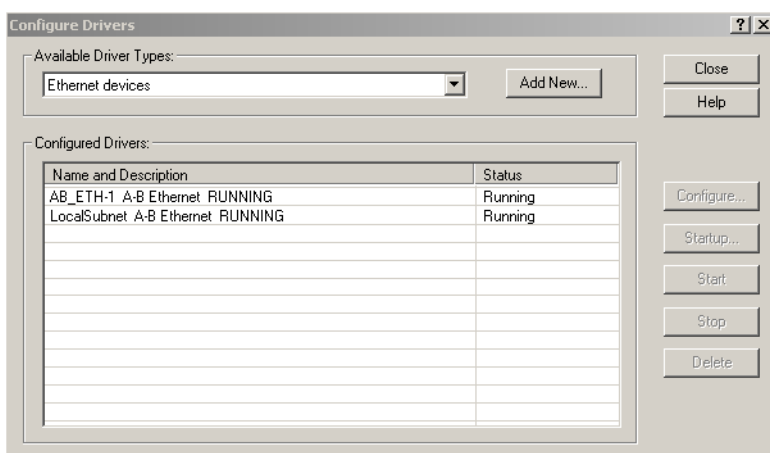


7. Type the IP address of your Logix Ethernet module.

The IP address shown is an example. Yours will be different.

8. Click OK.

The new Ethernet driver appears under Configured Drivers.



9. Click Close.
10. Minimize the RSLinx application dialog box.

Flash Firmware

Follow these steps to select the drive module to upgrade.

1. Open your ControlFLASH software.

You can access the ControlFLASH utility software by either of these methods:

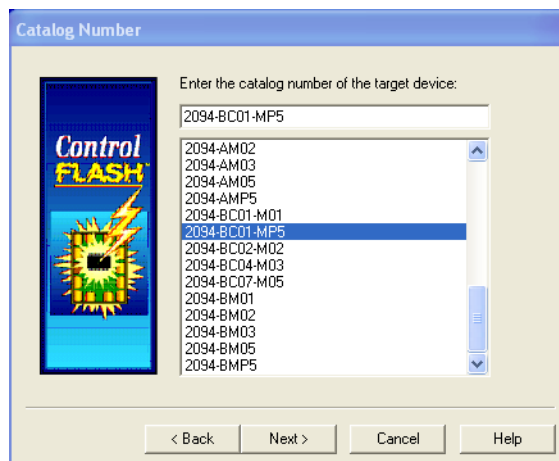
- From the Tools menu in RSLogix 5000 software, choose ControlFLASH.
- Choose Start>Programs>FLASH Programming Tools>ControlFLASH.

The Welcome to ControlFLASH dialog box opens.



2. Click Next.

The Catalog Number dialog box opens.

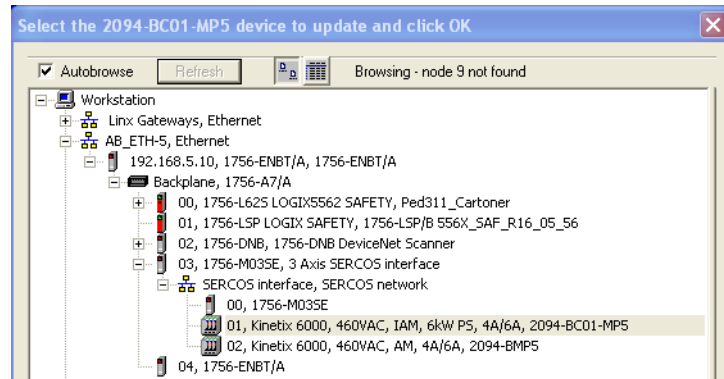


3. Select your drive module.

In this example, the 2094-BC01-MP5 IAM module is selected.

4. Click Next.

The Select Device to Update dialog box opens.

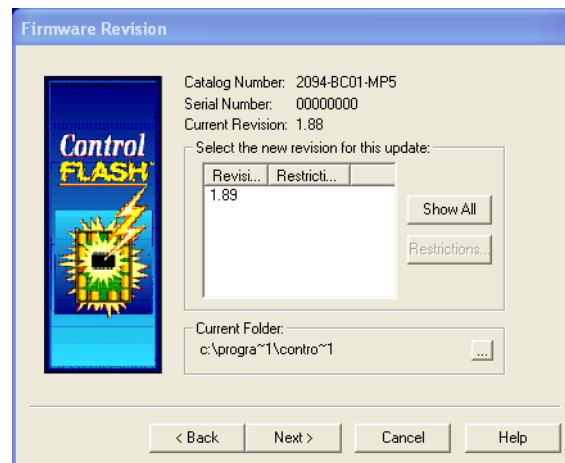


5. Expand your Ethernet node, Logix backplane, and EtherNet/IP network module.

6. Select the servo drive to flash.

7. Click OK.

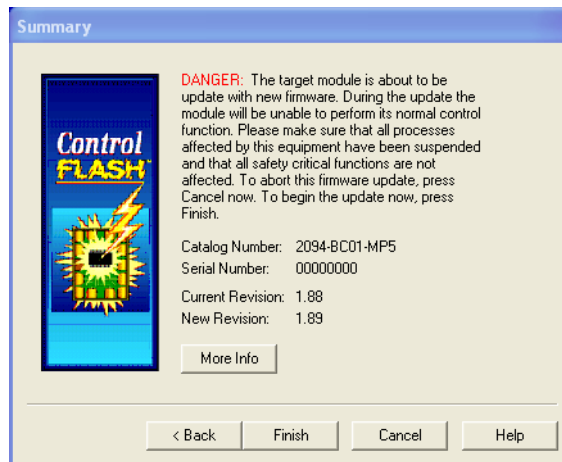
The Firmware Revision dialog box opens.



8. Select the firmware revision to flash.

9. Click Next.

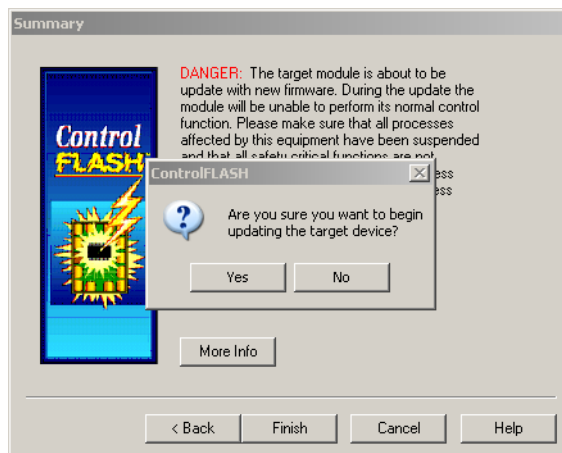
The Summary dialog box opens.



10. Confirm the drive catalog number and firmware revision.

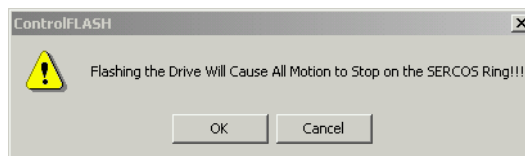
11. Click Finish.

This ControlFLASH warning dialog box opens.



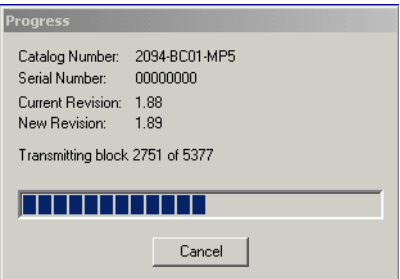
12. Click Yes (only if you are ready).

This ControlFLASH warning dialog box opens.



13. Acknowledge the warning and click OK.

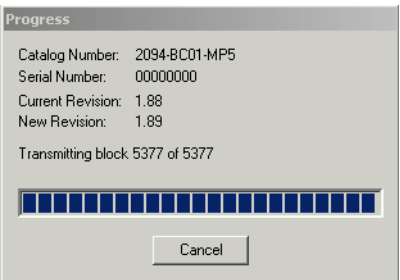
The Progress dialog box opens and flashing begins.



The drive module seven-segment status indicator changes from the fixed 2, 3, or 4 to F, which indicates that flashing is in progress.

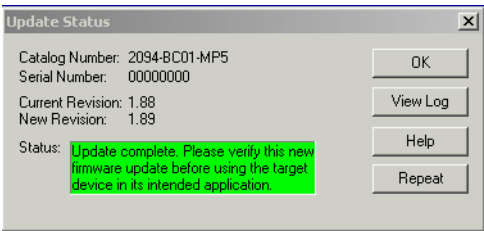
After the flash information is sent to the drive, the drive resets and performs diagnostic checking.

14. Wait for the Progress dialog box to time out.



15. The Update Status dialog box opens and indicates success or failure as described below.

Flashing Status	If
Success	1. Update complete appears in a GREEN Status dialog box. 2. Go to step 16 .
Failure	1. Update failure appears in a RED Status dialog box. 2. Refer to ControlFLASH Firmware Upgrade Kit Quick Start, publication 1756-QS105 , for troubleshooting information.



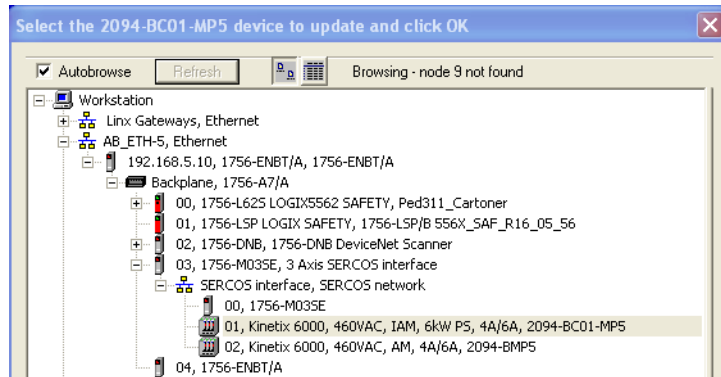
16. Click OK.

Verify the Firmware Upgrade

Follow these steps to verify your firmware upgrade was successful.

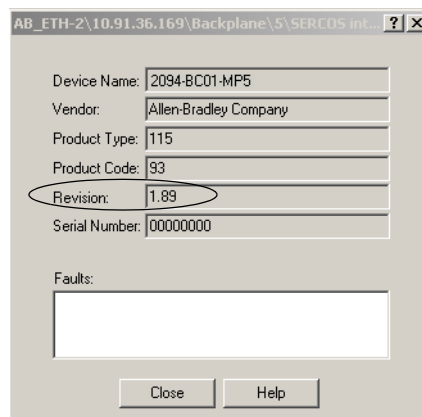
TIP Verifying the firmware upgrade is optional.

1. Open your RSLinx software.
2. From the Communications pull-down menu, choose RSWho.



3. Expand your Ethernet node, Logix backplane, and EtherNet/IP network module.
4. Right-click the drive module and choose Device Properties.

The Device Properties dialog box opens.



5. Verify the new firmware revision level.
6. Click Close.

Upgrade Drive Firmware with DriveExplorer Software

Upgrading axis module firmware by using DriveExplorer software involves setting the Axes to Flash parameter, configuring a HyperTerminal session, and flashing the firmware.

Before You Begin

You will need the following software and information before you begin.

Description	Cat. No.	Firmware Revision
DriveExplorer Software ⁽¹⁾	9306-4EXP02ENE	2.01 or later
Serial to SCANport Adapter	1203-SSS (Series B)	3.004 or later
RSLogix 5000 Software	9324-RLD300NE	11.0 or later
Firmware upgrade file for your Kinetix 6000 drive (IAM/AM) ⁽²⁾		
Personal computer with HyperTerminal software		

(1) Refer to DriveExplorer Getting Results Manual, publication [9306-GR001](#), for instructions.

(2) Contact Rockwell Automation Technical Support at (440) 646-5800 for firmware upgrade file.

IMPORTANT Control power must be present at CPD-1 and CPD-2 prior to flashing your drive.



ATTENTION: To avoid personal injury or damage to equipment during the firmware upgrade due to unpredictable motor activity, do not apply three-phase AC or common-bus DC input power to the drive. Do not establish communication with the Logix SERCOS interface module.

Select Axis Modules to Upgrade

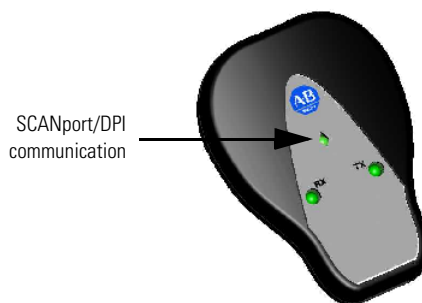
In this procedure you will use DriveExplorer software to set the Axes to Flash parameter (*x708*) and select the axis module to upgrade.

TIP You will save time by selecting only the axis modules that require a firmware upgrade.

Follow these steps to set the Axes to Flash parameter.

1. Connect the 1203-SSS serial cable to the appropriate COM port on your personal computer.
2. Connect the 1203-SSS SCANport cable to the SCANport/DPI connector on your IAM module.

3. Verify that the 1203-SSS has power by observing the status indicator in the figure below.

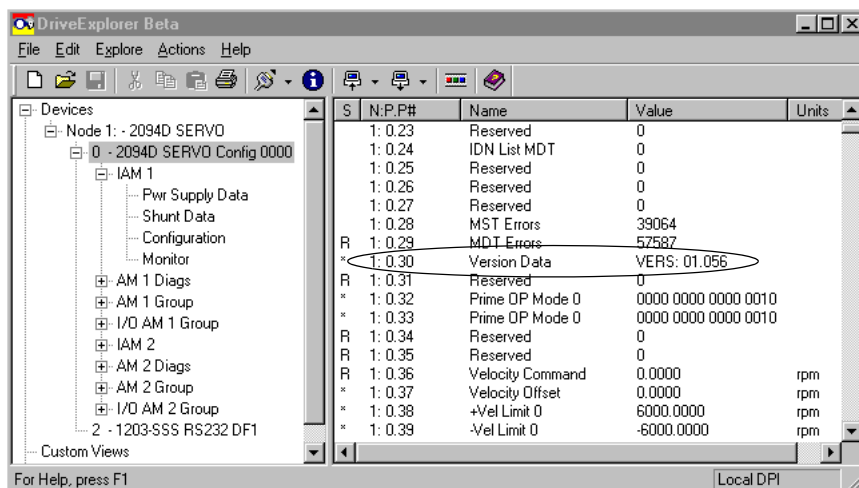
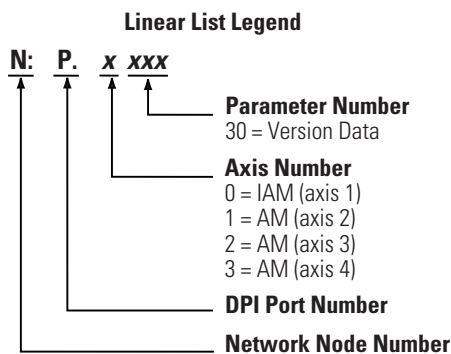


4. Open the DriveExplorer software and from the Explorer menu, choose Connect.

The DriveExplorer software proceeds to read your system.

5. Double-click 2094D SERVO Config 0000.

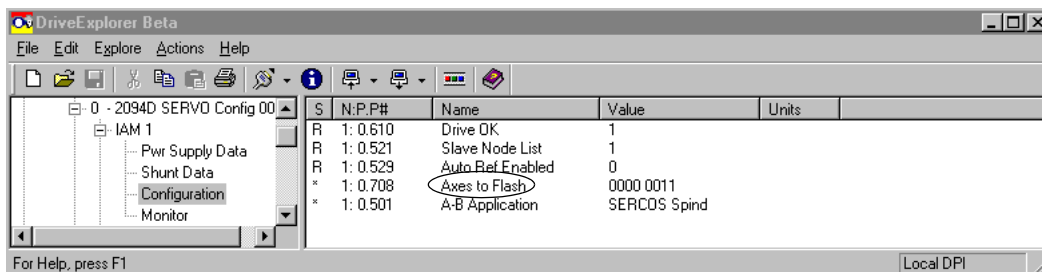
The linear list of parameters dialog box appears.



6. Scroll down to parameter x:x.30 (Version Data) and record the version (VERS: xx.xxx) of each axis module.

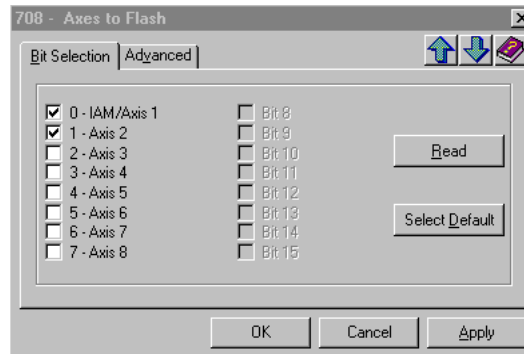
7. Double-click Configuration.

This dialog box opens.



8. Double-click Axes to Flash.

The Axis to Flash dialog box opens.



9. Click (check) each axis to flash.

Example above shows two axes to flash checked.

10. Click OK.

The Axes to Flash parameter is set.

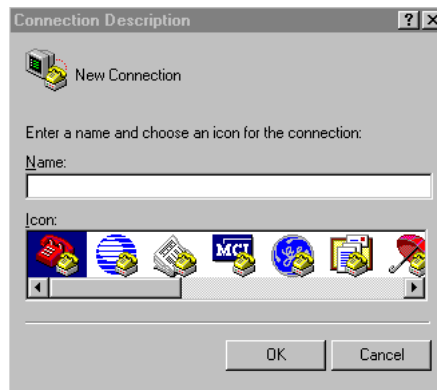
11. Close DriveExplorer software.

HyperTerminal Configuration

Follow these steps to begin a new HyperTerminal session.

1. From the Windows Start menu, choose Programs\Accessories\HyperTerminal\HyperTerminal.

The New Connection dialog box opens.



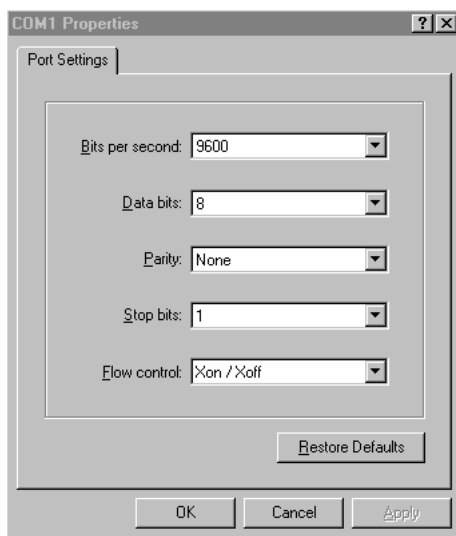
2. Type a name the new HyperTerminal file and choose an icon for the connection.
3. Click OK.

This dialog box opens.



4. From the Connect Using pull-down menu, choose the appropriate COM port.
5. Click OK.

This dialog box opens.



6. Choose the properties as shown above or as appropriate for your 1203-SSS SCANport adapter.

IMPORTANT

Bits per second of HyperTerminal must match the 1203-SSS SCANport adapter setting for connection to occur.

7. Click OK.
8. HyperTerminal configuration is complete.

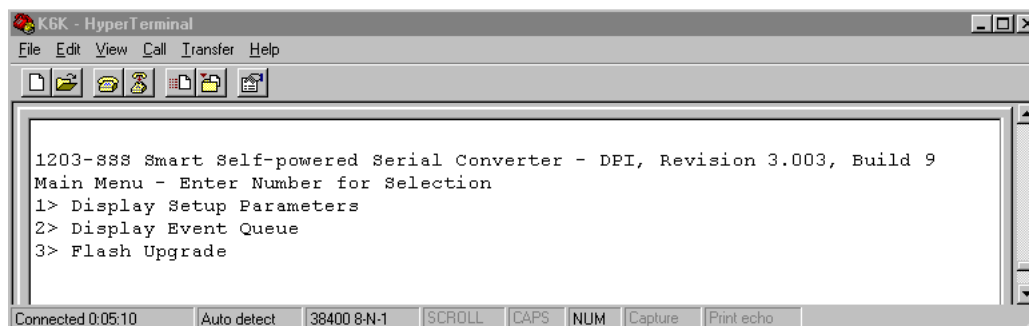
Flash Firmware

This procedure assumes that you have identified which axis modules require flashing, have set the Axes to Flash parameter, and have configured a HyperTerminal session.

IMPORTANT You must also know where to find your firmware upgrade file.

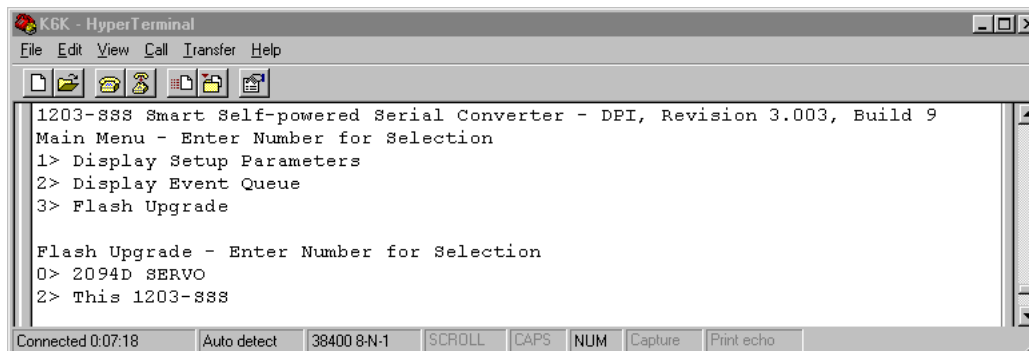
1. Press ENTER.

The HyperTerminal main menu opens.



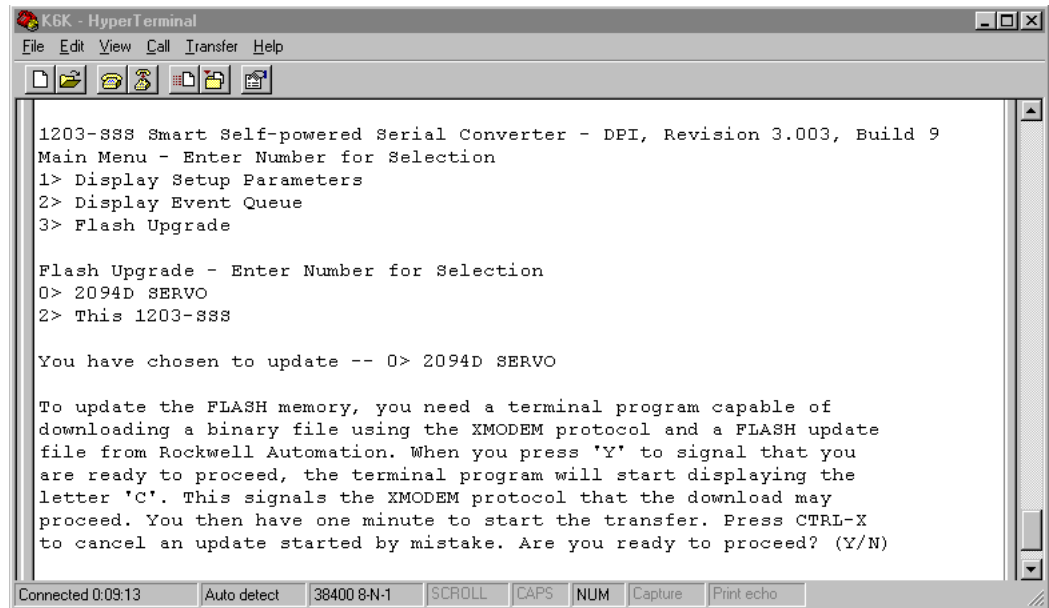
2. Enter 3.

This dialog box opens.



3. Enter 0.

This dialog box opens.



4. Enter Y.

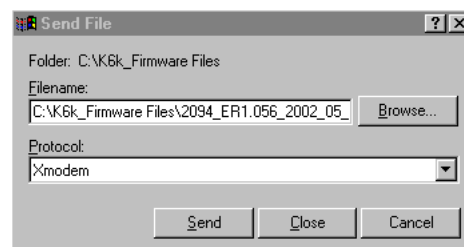
As indicated in the text, the program begins displaying the character C.

TIP Program times-out after 60 seconds. If program times-out before you complete steps [5...8](#), return to [step 1](#).

5. From the Transfer menu, choose Send File.

The Send File dialog box opens.

Firmware upgrade file, as provided by Rockwell Automation Technical Support at (440) 646-5800.

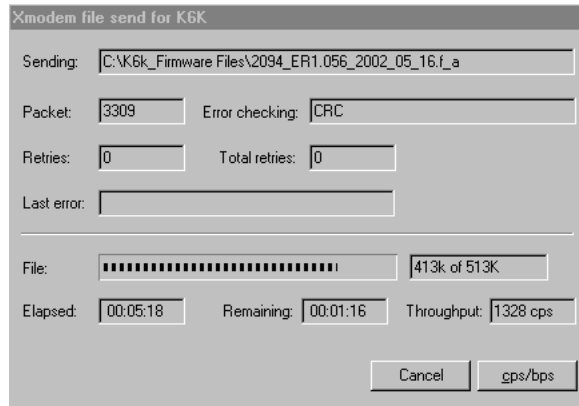


6. Browse for your firmware upgrade file.

7. From the Protocol pull-down menu, choose Xmodem.

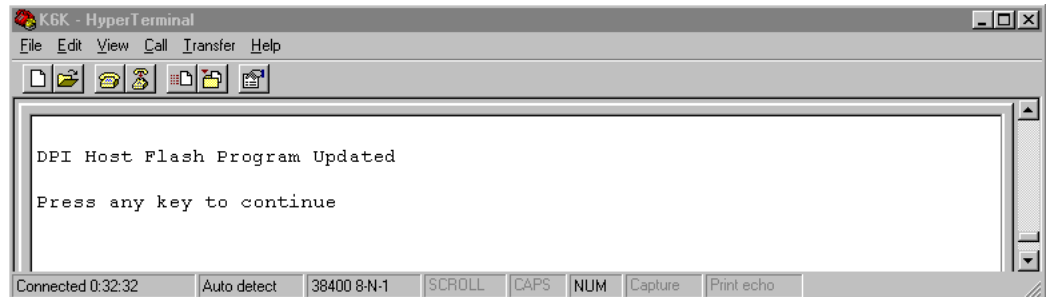
8. Click Send.

The flash upgrade operation begins and this dialog box opens.



ATTENTION: To avoid unrecoverable fault to drive modules, do not interrupt control power to IAM module, power to the 1203-SSS SCANport adapter, or power to your personal computer while the flash upgrade operation is in progress.

The flash operation completes and this dialog box opens.



9. Close the HyperTerminal session.
10. Verify that parameter 30 for each axis module is now upgraded to the new firmware revision.

Return to DriveExplorer software (refer to Select Axis Modules to Upgrade, [page 239](#)) to see the linear list of parameters.

DC Common Bus Applications

Introduction

This appendix provides integration procedures specific to Kinetix 6000 multi-axis drive systems configured for DC common bus. The procedure involves calculating capacitance values and setting the Additional Bus Capacitance parameter by using DriveExplorer or RSLogix 5000 software.

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Introduction	245
Before You Begin	245
Calculate Total Bus Capacitance	246
Calculate Additional Bus Capacitance	247
Bulletin 2094 Drive Capacitance Values	247
Common Bus Capacitance Example	248
Set the Additional Bus Capacitance Parameter with DriveExplorer Software	249

Before You Begin

These procedures assume you have mounted and wired your Kinetix 6000 DC common-bus system.

Before you set the Additional Bus Capacitance (Add Bus Cap) parameter in DriveExplorer or RSLogix 5000 software, you need to calculate these values:

- Total bus capacitance
- Additional bus capacitance

Calculate Total Bus Capacitance

Total bus capacitance is the sum of all capacitance values for your Bulletin 2094 common-bus modules. Specifically, this includes the capacitance values for each of these modules.

- Leader IAM (converter and inverter) module
- Each AM and shunt module (if present) on the leader IAM power rail
- Each follower IAM (converter and inverter) module
- Each AM module on the follower IAM power rail

Refer to Bulletin 2094 Drive Capacitance Values on [page 247](#) for IAM, AM, and shunt module capacitance values.

IMPORTANT If total bus capacitance of your system exceeds the leader IAM module pre-charge rating and input power is applied, the IAM module seven-segment status indicator will display error code E90 (pre-charge timeout fault).

To correct this condition, you must replace the leader IAM module with a larger module or decrease the total bus capacitance by removing AM modules.

Leader IAM (230V) Module	Maximum Bus Capacitance μF	Leader IAM (460V) Modules	Maximum Bus Capacitance μF
2094-AC05-MP5-x	7145	2094-BC01-MP5-x	4585
2094-AC05-M01-x		2094-BC01-M01-x	
2094-AC09-M02-x	15,295	2094-BC02-M02-x	8955
2094-AC16-M03-x	34,400	2094-BC04-M03-x	8955
2094-AC32-M05-x	62,825	2094-BC07-M05-x	17,915

IMPORTANT If your total bus capacitance value exceeds the value in the table above, you must increase the size of the leader IAM module or decrease the total bus capacitance by removing AM modules.

Calculate Additional Bus Capacitance

Additional bus capacitance is the sum of all follower IAM and AM module capacitance values for your Bulletin 2094 common-bus modules. Specifically, this includes the capacitance values for each of these modules.

- Each follower IAM (converter and inverter) module
- Each AM module on the follower IAM module power rail

Enter the additional bus capacitance value in [step 6](#) of Set the Additional Bus Capacitance Parameter.

Bulletin 2094 Drive Capacitance Values

Use these tables when calculating total bus capacitance and additional bus capacitance for your Bulletin 2094 common-bus application.

Table 125 - IAM/AM (230V) Modules

IAM Converter (230V)	Capacitance μF	AM Inverter (230V)	Capacitance μF
2094-AC05-MP5-x	270	2094-AMP5-x	390
2094-AC05-M01-x		2094-AM01-x	660
2094-AC09-M02-x	540	2094-AM02-x	780
2094-AC16-M03-x	1320	2094-AM03-x	1320
2094-AC32-M05-x	1980	2094-AM05-x	2640

Table 126 - IAM/AM (460V) Modules

IAM Converter (460V)	Capacitance μF	AM Inverter (460V)	Capacitance μF
2094-BC01-MP5-x	110	2094-BMP5-x	75
2094-BC01-M01-x		2094-BM01-x	150
2094-BC02-M02-x	220	2094-BM02-x	270
2094-BC04-M03-x	940	2094-BM03-x	840
2094-BC07-M05-x	1410	2094-BM05-x	1175

Table 127 - Shunt Module (230/460V)

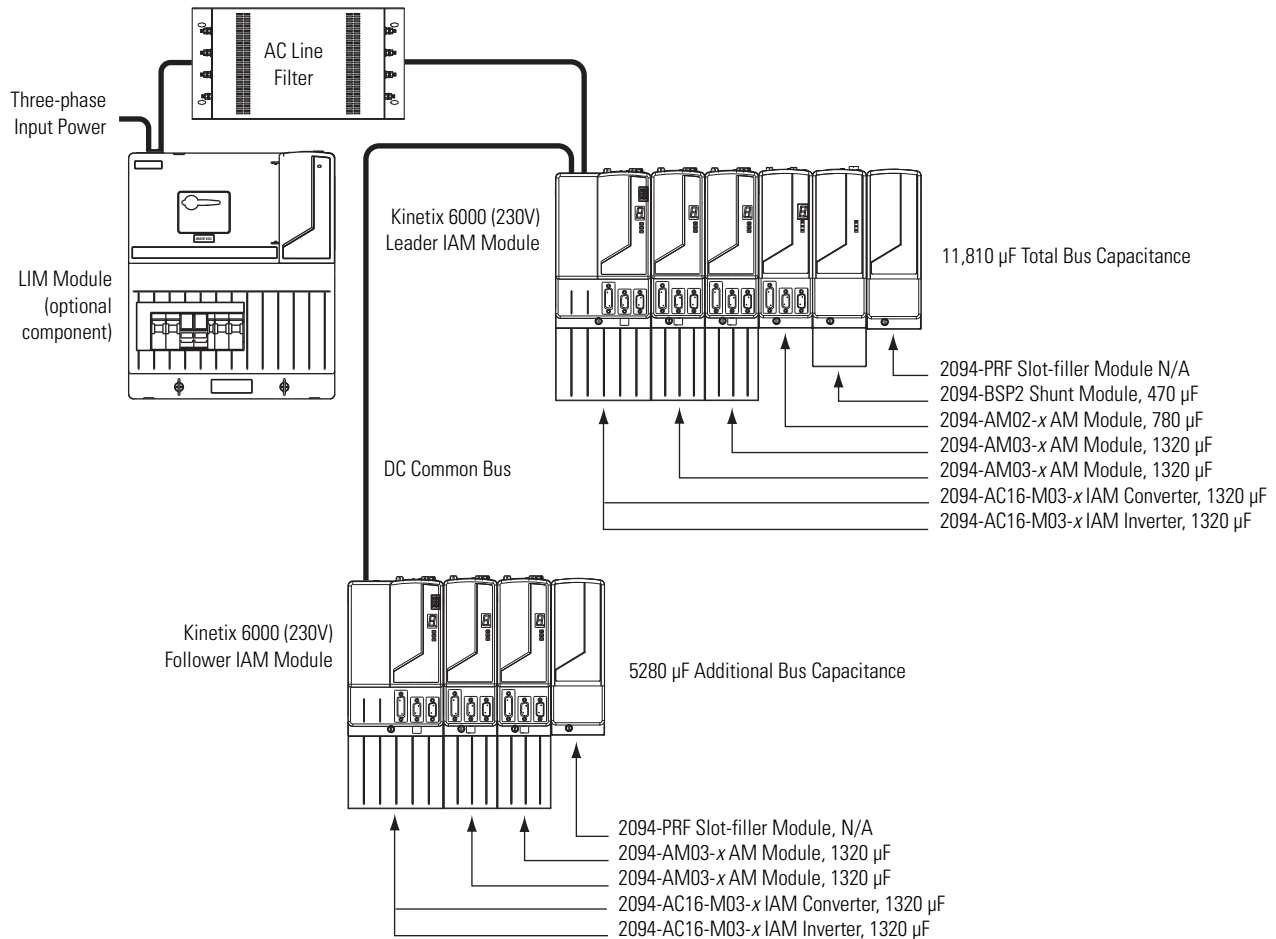
SM (230-460V)	Capacitance μF
2094-BSP2	470

Common Bus Capacitance Example

In this example, the sum of the leader IAM power rail modules capacitance (6530 μF) and the follower IAM power rail modules capacitance (5280 μF) equals 11,810 μF total bus capacitance.

The sum of the follower IAM module power rail equals 5280 μF additional bus capacitance.

Figure 113 - Calculating Common Bus Capacitance



Set the Additional Bus Capacitance Parameter with DriveExplorer Software

In this section you set the Add Bus Cap parameter by using DriveExplorer software.

TIP

You can also set the Add Bus Cap parameter by changing IDN parameter values. Refer to Appendix E on [page 253](#) for more information.

The following hardware and software tools are required to provide the necessary communication link between your personal computer and the Kinetix 6000 drive system running DriveExplorer software.

Description	Cat. No.	Version
DriveExplorer Software ^{(1) (2)}	9306-4EXP02ENE	2.01 or later
Serial to SCANport Adapter ^{(2) (3)}	1203-SSS (Series B)	3.004 or later
RSLogix 5000 Software	9324-RLD300NE	15.0 or later

(1) Refer to DriveExplorer Getting Results Manual, publication [9306-GR001](#), for instructions.

(2) Additional information regarding these communication and software tools is available at <http://www.ab.com/support/abdrives>.

(3) Refer to 1203-SSS (series B) FRN 3.xxx User Manual, publication [20COMM-UM001](#), for instructions.



ATTENTION: To avoid personal injury or equipment damage, at least one end of a SERCOS fiber-optic cable must be disconnected from the drive. This makes sure that motion will not occur while changes are being made to the Add Bus Cap parameter.

Remove SERCOS Communication

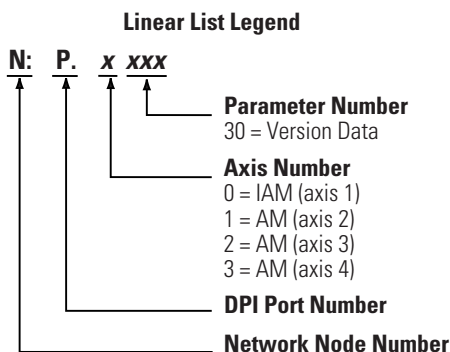
Follow these steps to remove (break) SERCOS communication.

1. Remove three-phase and control power from the Kinetix 6000 drive system.
2. Remove one of the SERCOS fiber-optic cables.
Fiber-optic cable connections (Tx and Rx) are located on the top of each IAM/AM module.
3. Re-apply three-phase and control power.

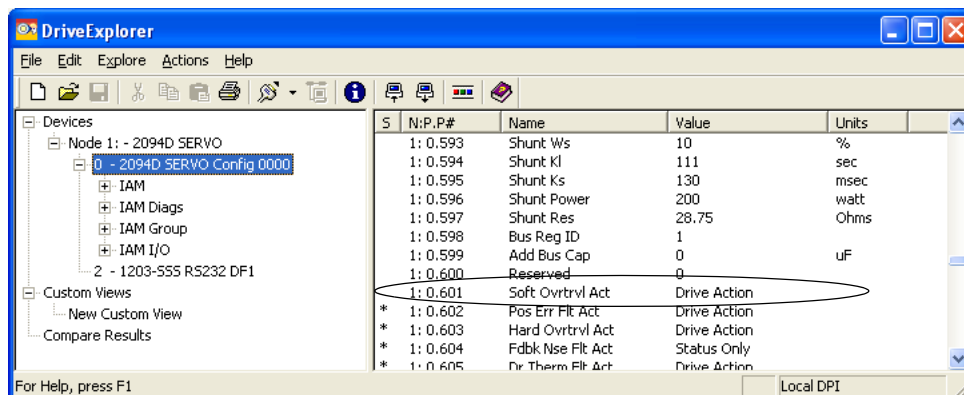
Set the Additional Bus Capacitance Parameter

Follow these steps to set the Additional Bus Capacitance parameter.

1. Start your DriveExplorer software.
2. From the Explore menu, choose Connect>Local or press Ctrl+L.
DriveExplorer software will read your system.
3. Observe the Linear List of parameters as grouped by Node, Port, and Axis hierarchy as shown below.

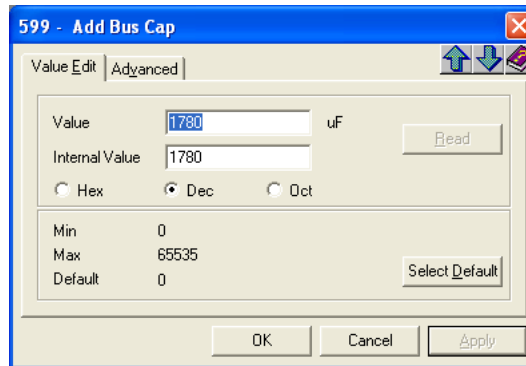


4. Choose Devices>Node>Product and navigate to the parameter x:x:x599 as shown below.



5. Double-click the x:x:x599 Add Bus Cap parameter.

The command dialog box for parameter $x599$ - Add Bus Cap opens.



6. Click the Value Edit tab and enter the Add Bus Cap Value (μF).
7. Click OK.

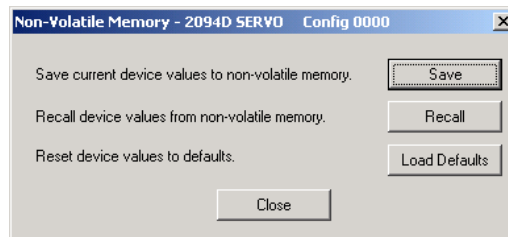
The RBM module delay time is changed, but not saved in non-volatile memory.

Save the Add Bus Cap Parameter to Non-volatile Memory

Follow these steps to save the Add Bus Cap parameter to non-volatile memory.

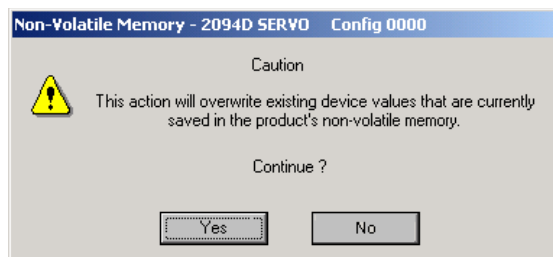
1. From the Actions menu, choose Non-volatile Memory.

This message dialog box opens.



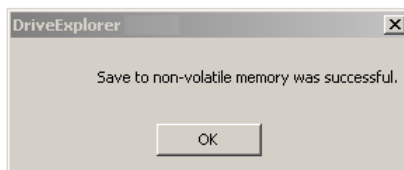
2. Click Save.

The changes are saved to non-volatile memory and this cautionary message dialog box opens.



3. Click Yes.

The save to non-volatile memory is complete and this confirmation message dialog box opens.



4. Click OK.
5. Close the DriveExplorer software.

Reconnect SERCOS Communication

Follow these steps to reconnect SERCOS communication.

1. Remove three-phase and control power from the Kinetix 6000 drive system.
2. Replace the SERCOS fiber-optic cable removed earlier.

Fiber-optic cable connections (Tx and Rx) are located on the top of each IAM/AM module.

3. Re-apply three-phase and control power.

Changing the Default IDN Parameter Values

Introduction

This appendix provides a procedure, specific to the Kinetix 6000(SERCOS) drive systems, for changing IDN parameter values to non-default values when your application does not match the default configuration.

Topic	Page
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Change IDN Parameter Values	254

Before You Begin

The Logix processor contains a motion planner that sends real-time and non real-time data to the drive. This drive communication is performed via a set of SERCOS interface telegrams. Each telegram has an identification or Ident (IDN) number. All parametric data, such as scaling and loop gains, and real-time loop closure information is configured this way.

Table 128 - IDN Instruction Format in the IEC Standard Document

IDN Number	Name			
	Function/Description			
	Length in bytes	Minimum input value/ Maximum input value	Scaling/resolution	Units

There are default parameters in the Logix-to-Kinetix 6000 drive product structure you can reconfigure when the default configuration does not match the Integrated Architecture machine configuration.

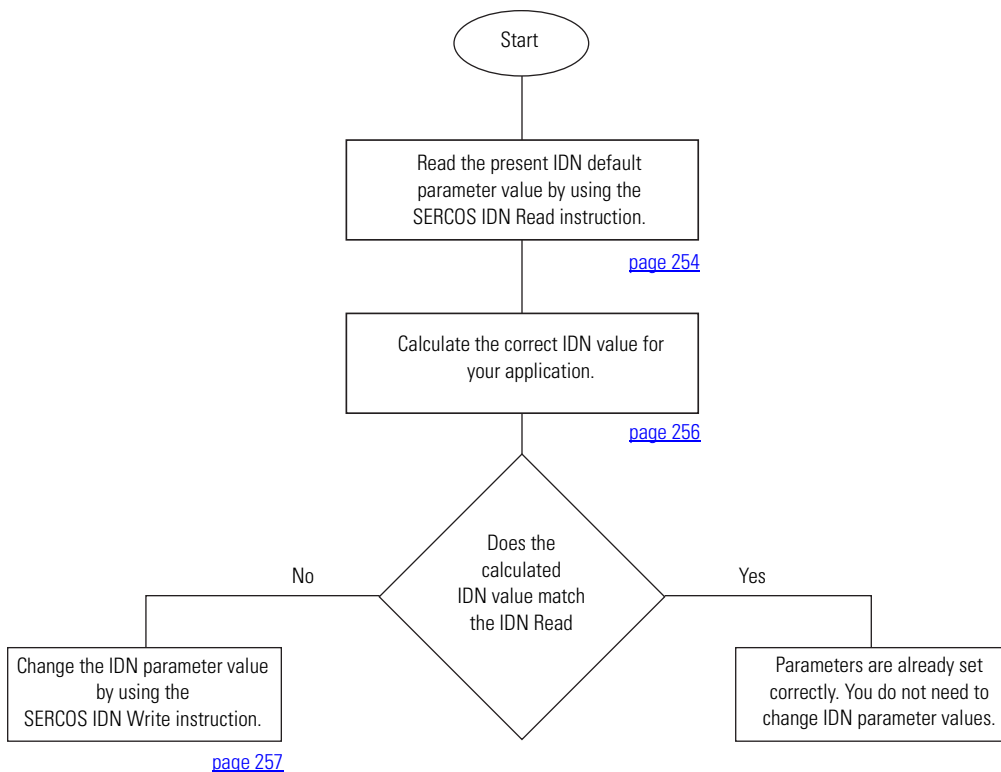
Using this procedure, you can change the Additional Bus Capacitance value in common-bus configurations.

TIP

You can also set the Additional Bus Capacitance parameter by using DriveExplorer software. Refer to Appendix D on [page 245](#) for more information.

Use this flowchart to determine if changing your default configuration is required.

Figure 114 - Configuration Flowchart



Change IDN Parameter Values

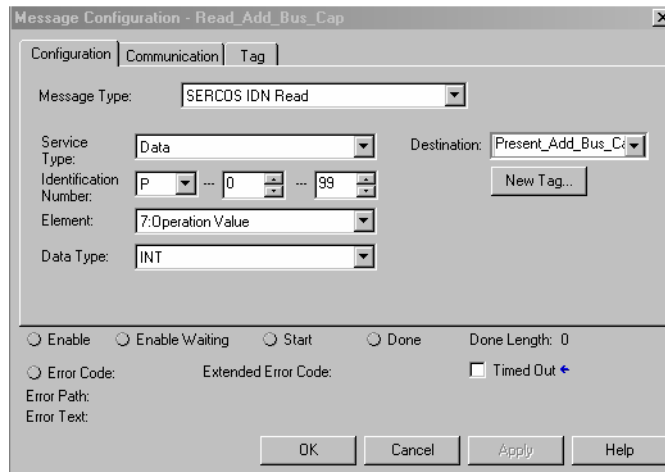
In this section you follow the Configuration Flowchart on [page 254](#) to determine if you need to use the SERCOS IDN Write instruction in RSLogix 5000 software to change the IDN parameter values.

Read the Present IDN Parameter Value

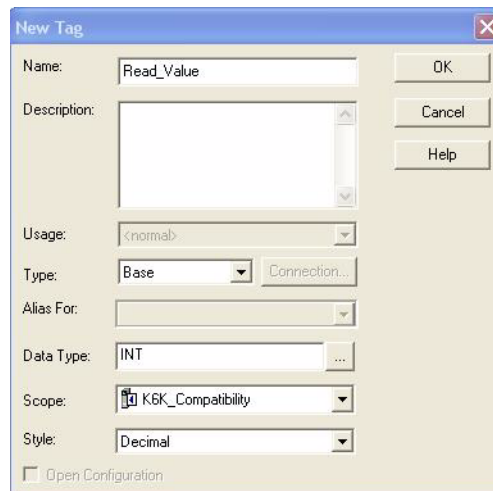
Follow these steps to read the present IDN value.

1. Start your RSLogix 5000 software application program.
2. Configure a Message Configuration (MSG) instruction to read your present IDN parameter values.

In this example, the Message Configuration (MSG) instruction is set to read the additional bus capacitance of your leader IAM power module.



- a. From the Message Type pull-down menu, choose SERCOS IDN Read.
- b. From the Identification Number pull-down menus, choose P-0-99.
3. Click New Tag.
4. The New Tag dialog box opens.

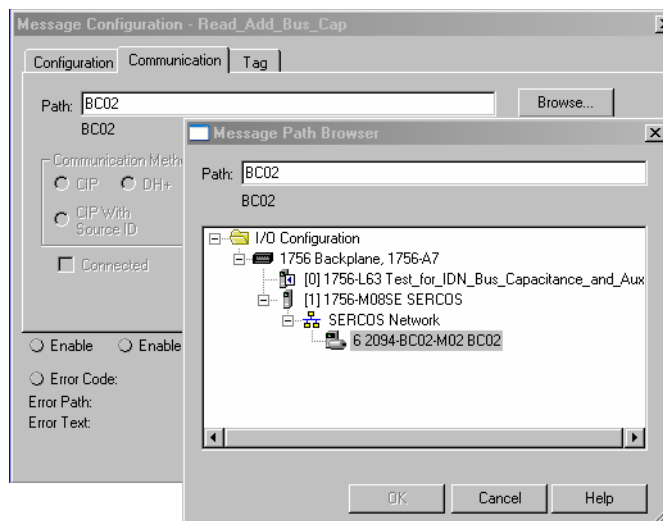


5. Type the name of your Destination tag.
In this example, the tag name is Read_Value.
6. Click OK.

In this example, the MSG instruction reads the P-0-99 IDN value and places it in the destination as specified by the new tag.

7. Click the Communication tab.

8. Click Browse.



9. Select the Bulletin 2094 module to read the MSG instruction.

10. Click OK.

Calculate the New IDN Value

Changing the additional bus capacitance value requires calculations. Determine the sum of all capacitance values for the follower IAM module and each AM module on the follower IAM power rail.

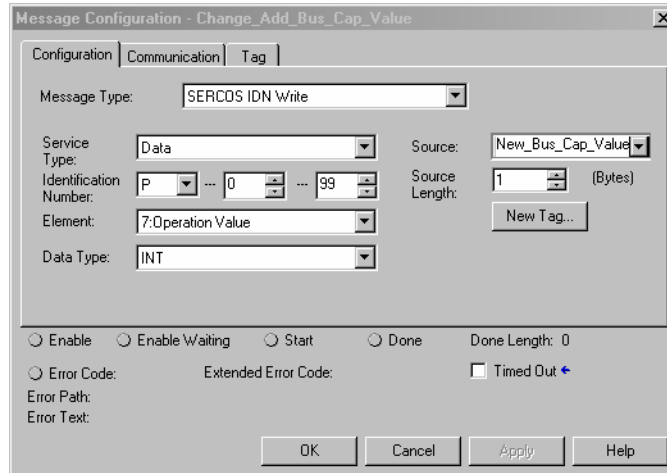
Refer to Calculate Additional Bus Capacitance on [page 247](#) for more information.

Write the New IDN Parameter Value

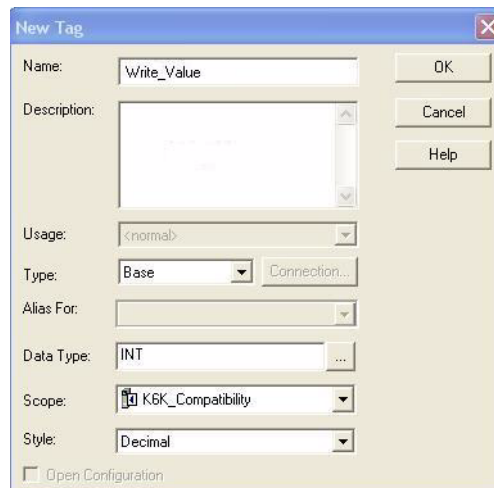
Follow these steps to write the new IDN parameter value.

1. Configure a Message Configuration (MSG) instruction to write the IDN parameter value required for your application.

In this example, the Message Configuration (MSG) instruction is set to write the additional bus capacitance of your leader IAM power module.



- a. From the Message Type pull-down menu, choose SERCOS IDN Write.
 - b. From the Identification Number pull-down menus, choose P-0-99.
2. Click New Tag.
 3. The New Tag dialog box opens.

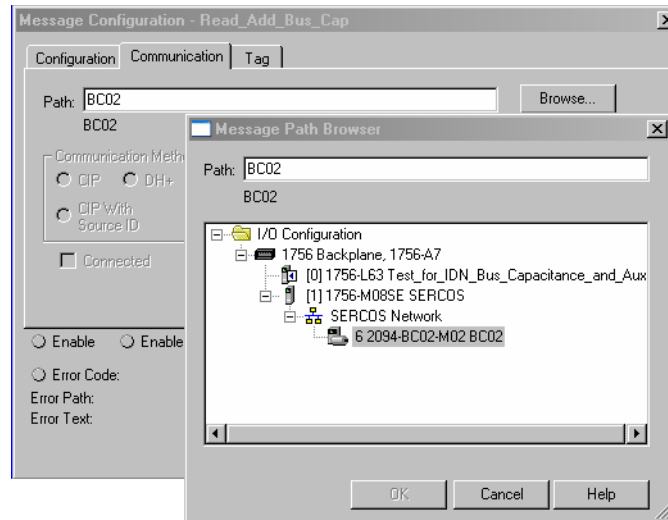


4. Type the name of your Source tag.
In this example, the tag name is Write_Value.
5. Click OK.

In this example, the new tag creates a source value (that you entered) that the MSG instruction uses to overwrite the existing P-0-099 IDN value.

6. Click the Communication tab.

The Communication tab opens.



7. Click Browse.
8. Select your Bulletin 2094 module.
9. Click OK.

The MSG instruction writes the new IDN value to your drive.

TIP To verify your SERCOS IDN Write instruction was successful, you can perform another SERCOS IDN Read instruction for the IDN in question.

10. Click OK to close the Message Configuration dialog box.

RBM Module Interconnect Diagrams

Introduction

This appendix provides Bulletin 2090 Resistive Brake Module (RBM) interconnect diagrams specific to Kinetix 6000 multi-axis servo-drive systems with and without the safe-off feature.

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Kinetix 6000 drives with the safe-off feature have the -S designation at the end of the catalog number. For example, the 2094-AM01-S AM module includes safe-off and the 2094-AM01 AM module does not.

Before You Begin

These procedures assume you have installed your RBM module with the Kinetix 6000 servo-drive system. For RBM module installation instructions, refer to the Resistive Brake Module Installation Instructions, publication [2090-IN009](#).

IMPORTANT Drive firmware revision 1.071 or later is required to use the RBM module with Kinetix 6000 drives.

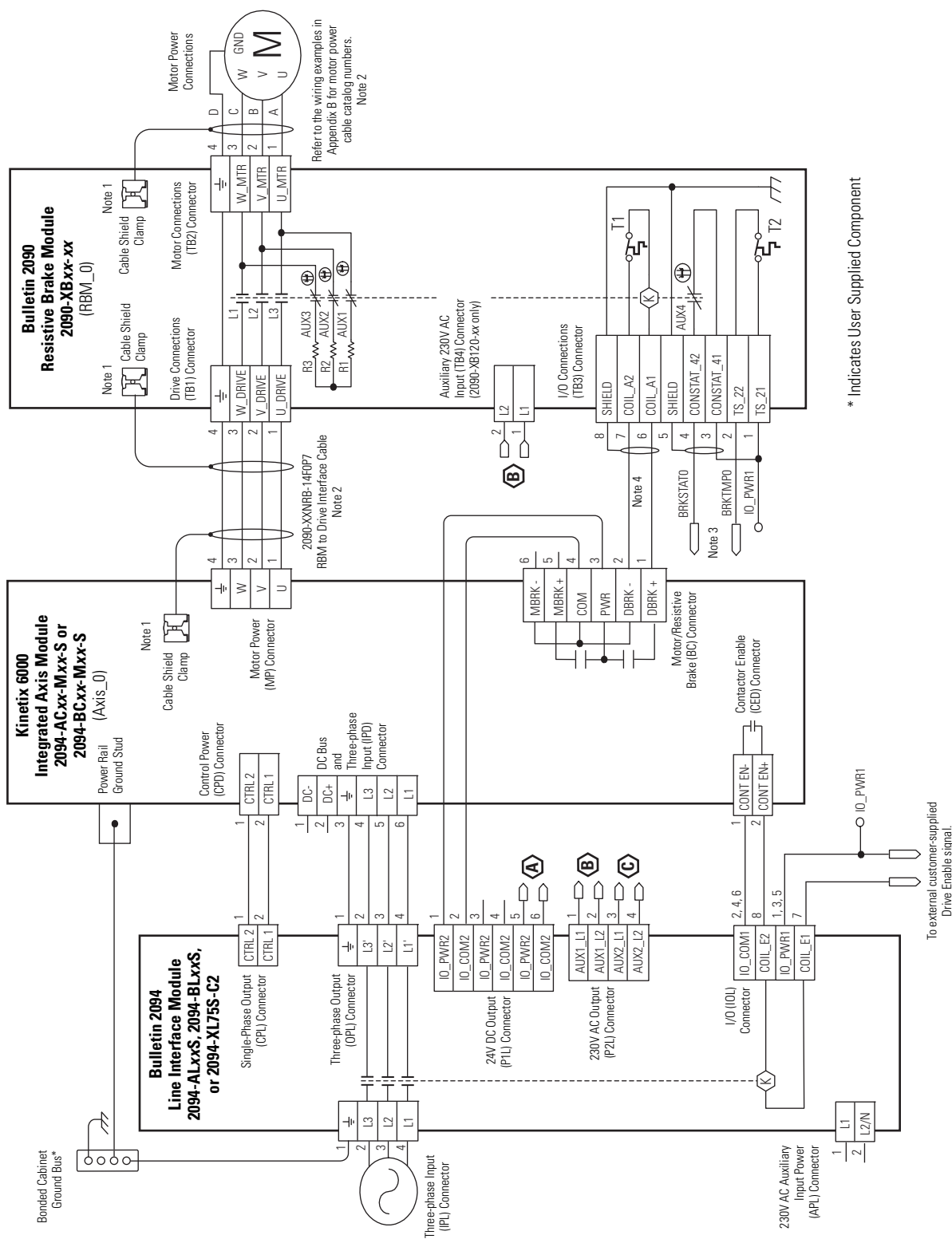


ATTENTION: The interconnection diagrams should be used as a general recommendation on how the safety control circuit may be implemented. Actual applications may vary due to requirements based on the machine builders risk assessment. The machine builder must perform a risk assessment and determine a category level of safety that must be applied to the machine.

For Kinetix 6000 drive systems, you can set the delay time for your RBM module in RSLogix 5000 software. Refer to Configure Axis Properties on [page 142](#).

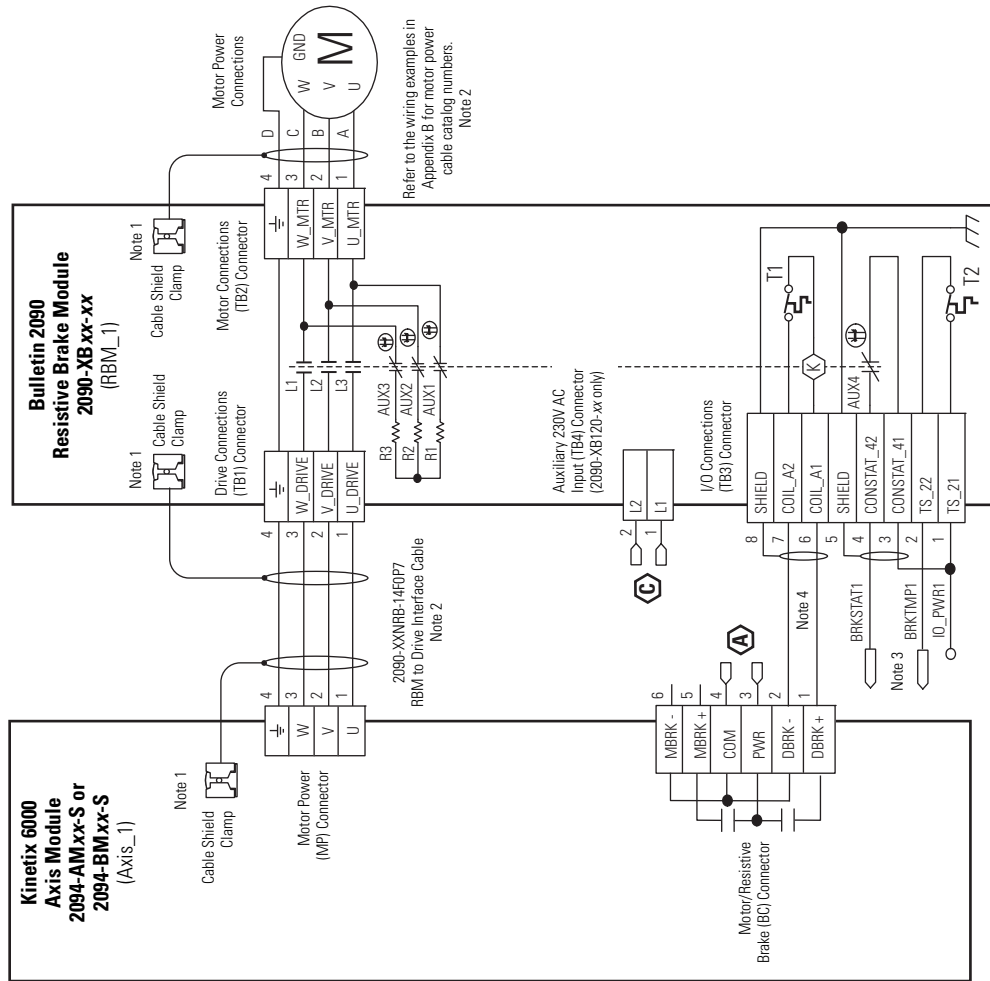
This example diagram shows 2094-xCxx-Mxx-S and 2094-xMxx-S drives (with safe off) and 2094-ALxxS, 2094-BLxxS, and 2094-XL75S LIM modules wired with the Bulletin 2090 RBM module.

Figure 115 - RBM Wiring Example



* Indicates User Supplied Component

RBM Wiring Example (Continued)



* Indicates User Supplied Component

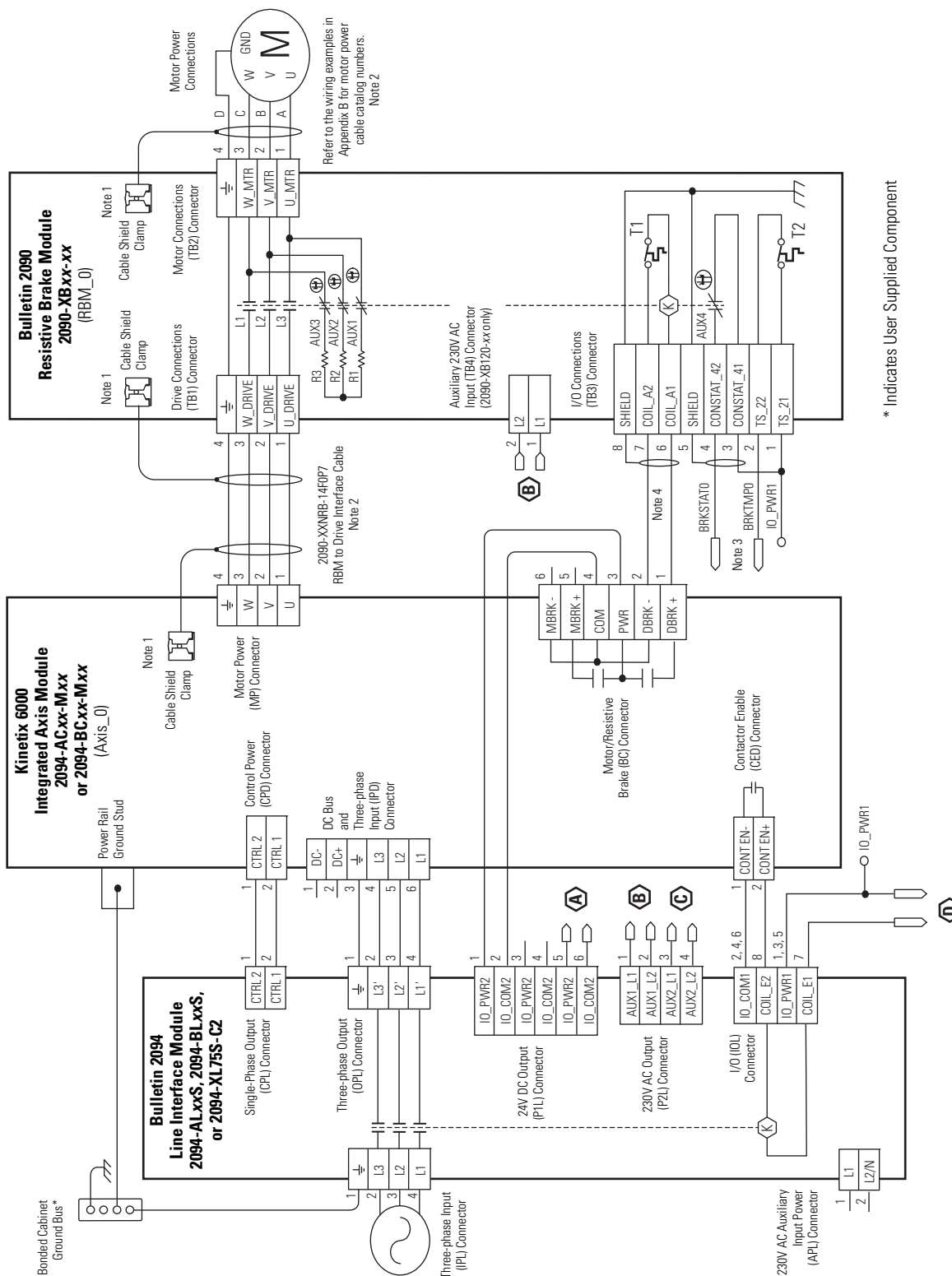


ATTENTION: The National Electrical Code and local electrical codes take precedence over the values and methods provided. Implementation of these codes is the responsibility of the machine builder.

Note	Information
1	Cable shield clamp must be used in order to meet CE requirements. No external connection to ground required.
2	For motor cable specifications, refer to the Kinetix Motion Control Selection Guide, publication GMC-SG001 .
3	The BRKTMP0 signal can be wired to a ControlLogix input as overtemp warning in user program.
4	Firmware revision 1.071 or later is required to use the DBRK outputs on the Kinetix 6000 IAM or AM module.
5	The safety relay time delay should be set beyond the time required to stop and disable the axis when running at full speed.
6	Drive Enable Input Checking must be selected when configuring Axis Properties in RSLogix 5000 software.

This example diagram shows 2094-*x*C*xx*-*Mxx* and 2094-*x**Mxx* drives (without safe off) and 2094-*ALxx*S, 2094-*BLxx*S, and 2094-*XL75S* LIM modules wired with the Bulletin 2090 RBM module.

Figure 116 - RBM Wiring Example, Category 2 Configuration per EN954-1

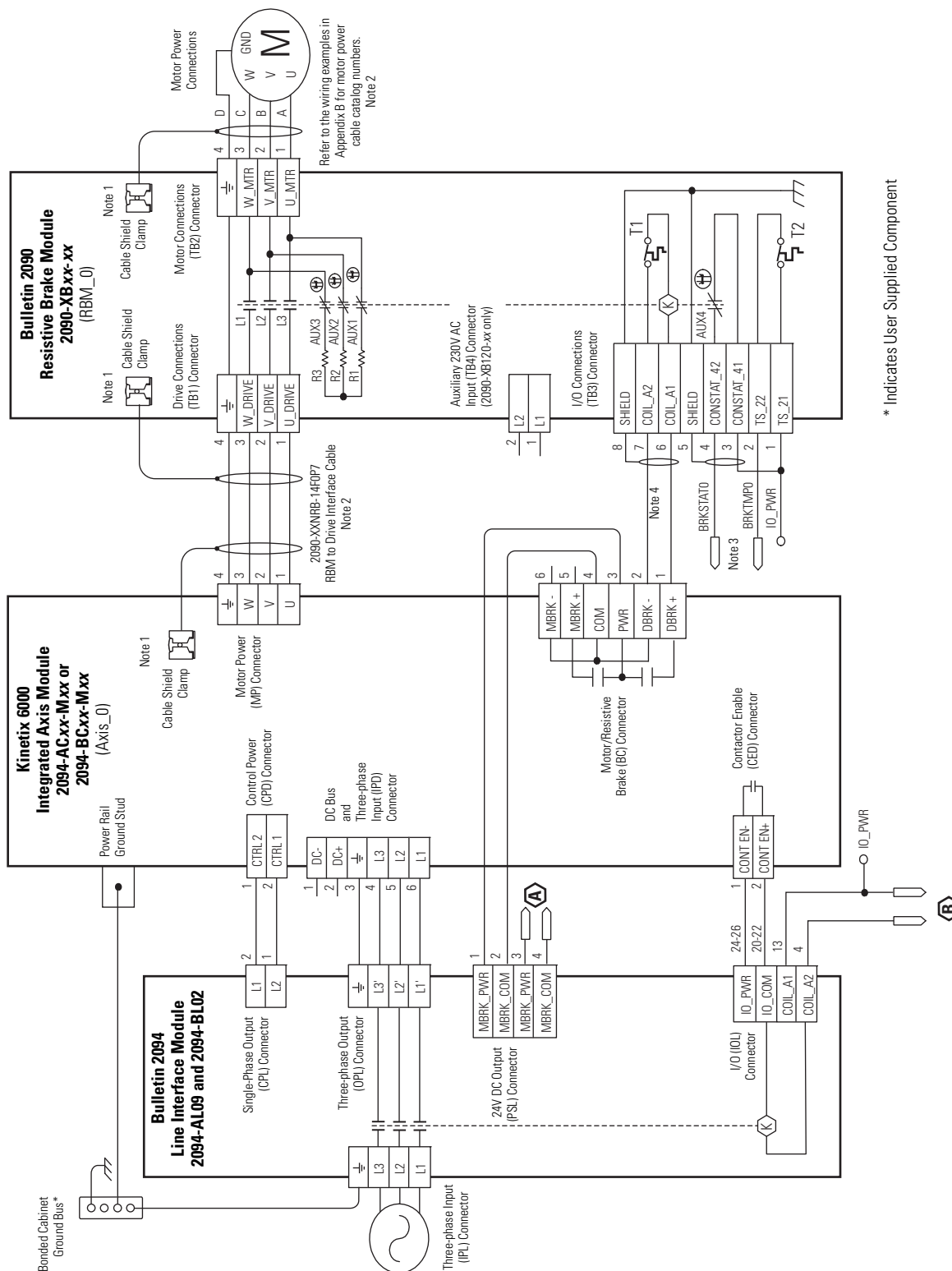


RBM Wiring Example, Category 2 Configuration per EN954-1 (Continued)

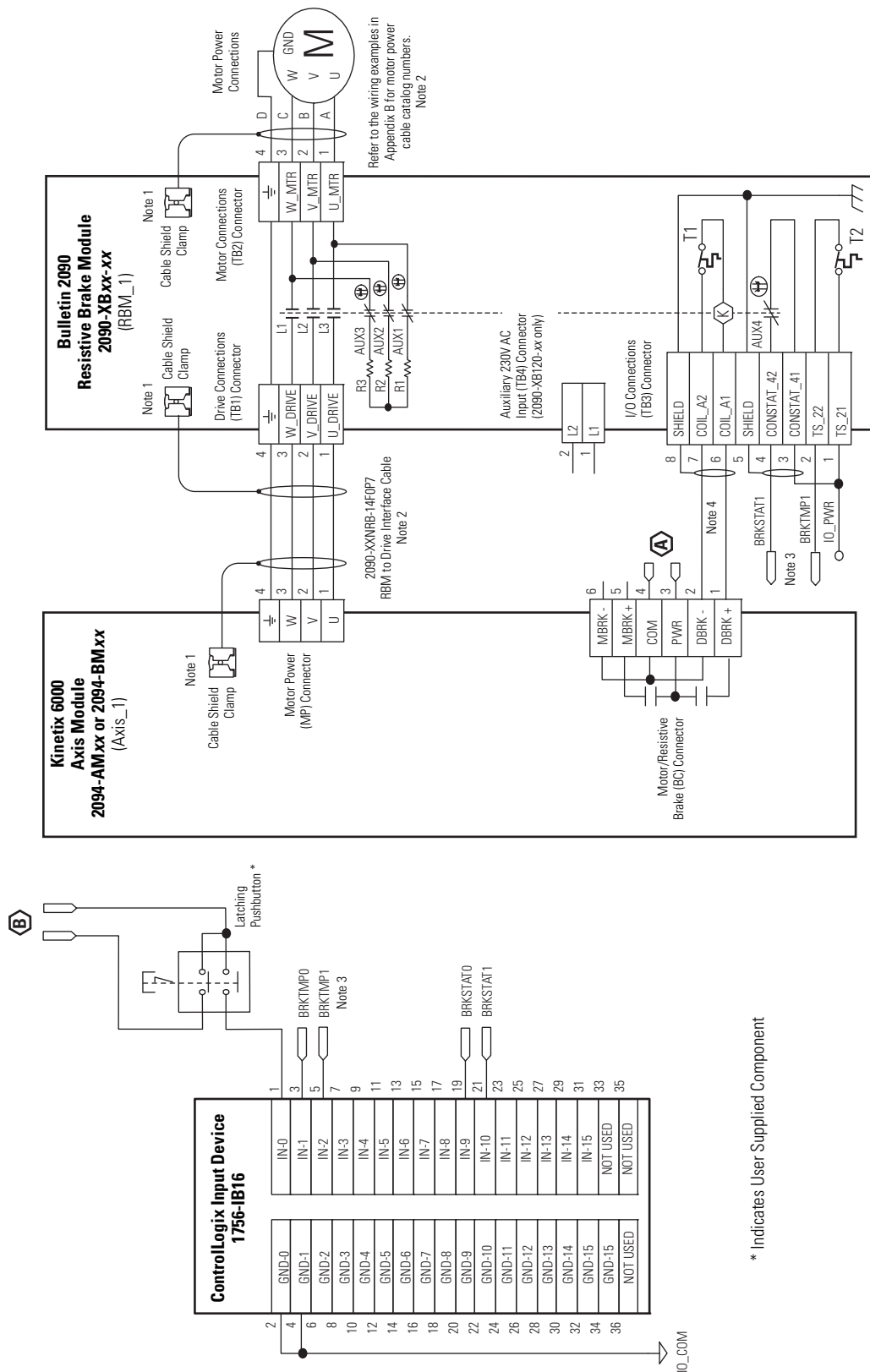


This example diagram shows 2094-*x*Cxx-Mxx and 2094-*x*Mxx drives (without safe off) and 2094-AL09 and 2094-BL02 LIM modules wired with the Bulletin 2090 RBM module.

Figure 117 - RBM Wiring Example, Category 2 Configuration per EN954-1

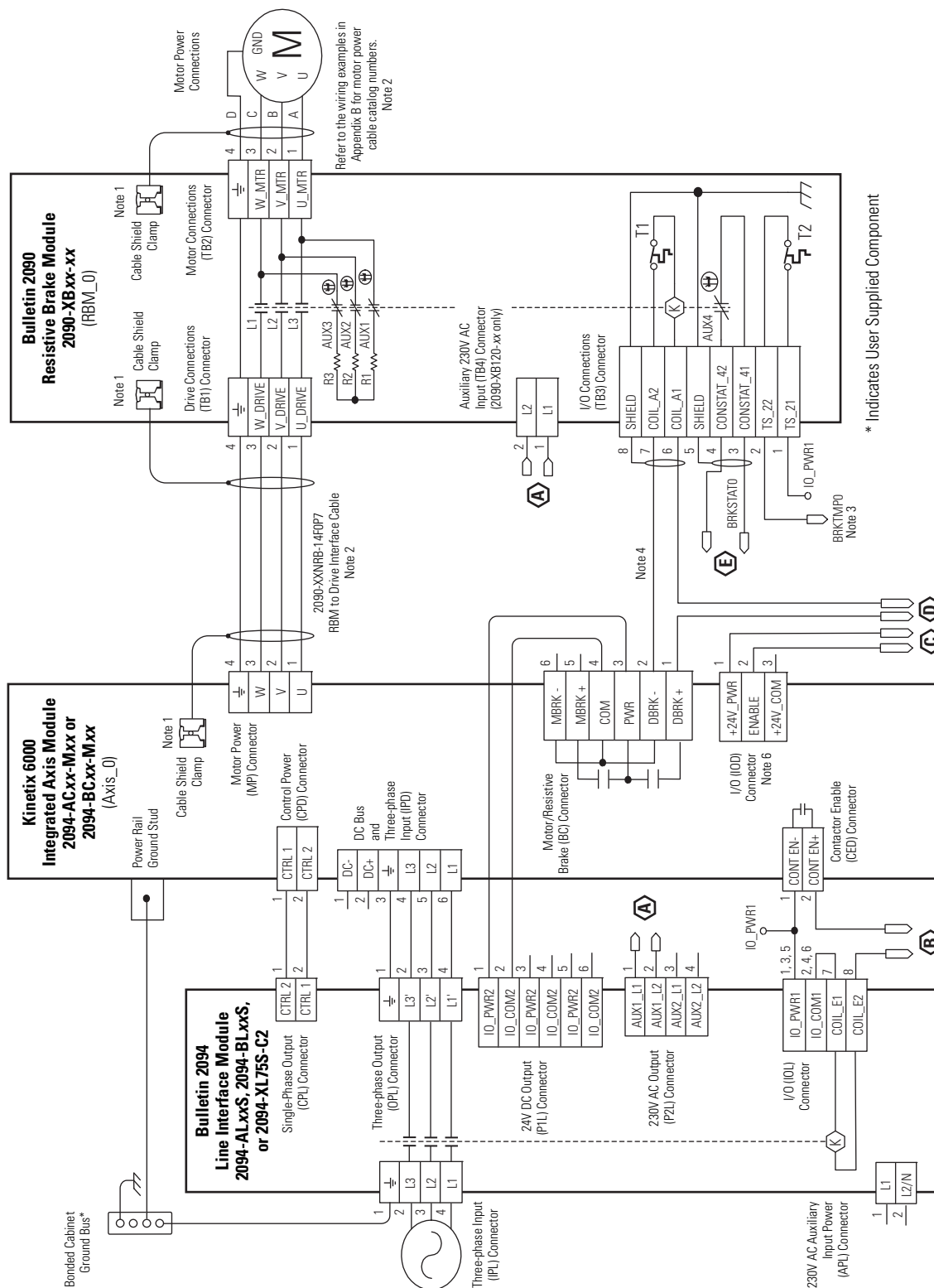


RBM Wiring Example, Category 2 Configuration per EN954-1 (Continued)

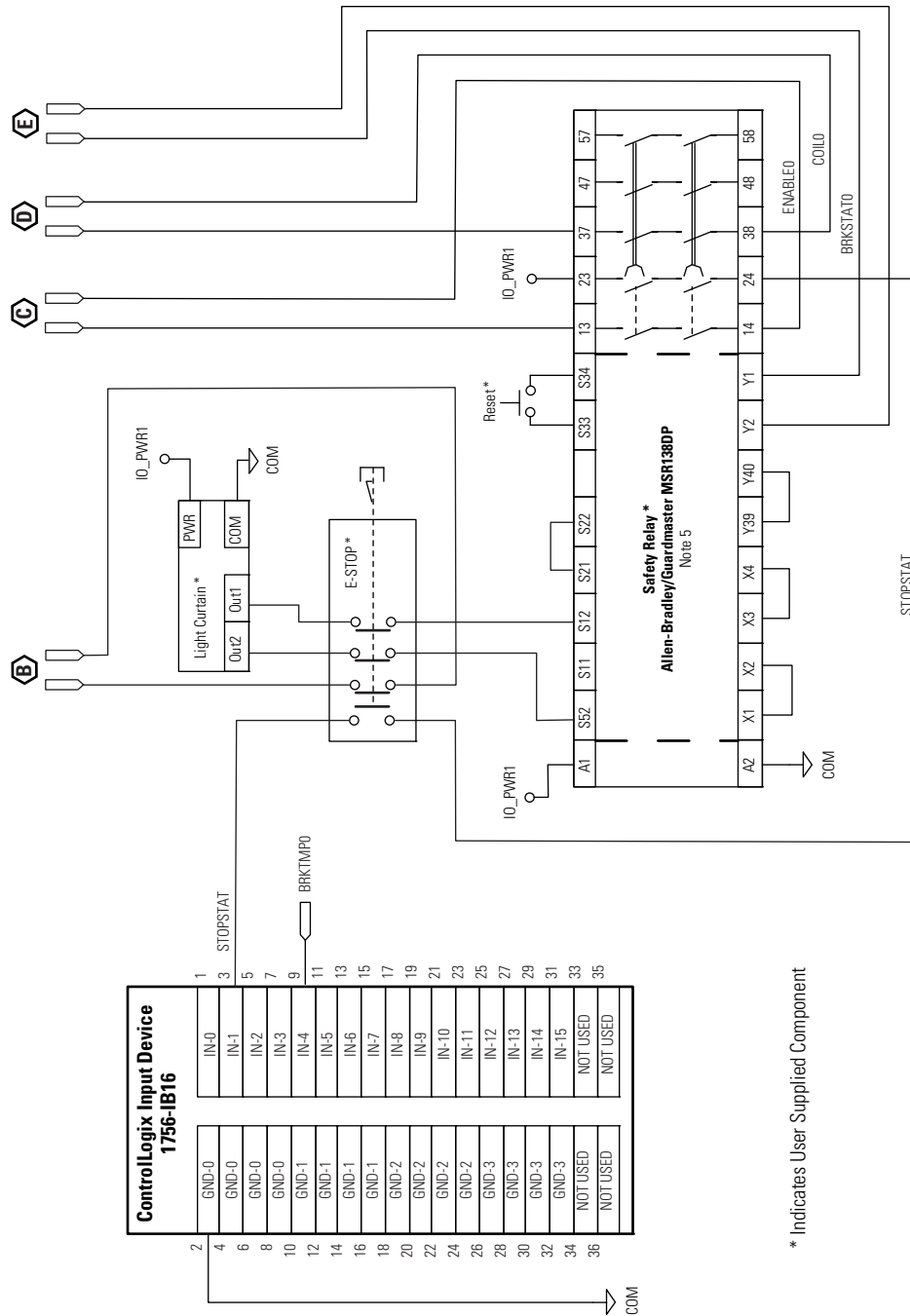


This example diagram shows 2094-*x*Cxx-Mxx drives (without safe off) and 2094-ALxxS, 2094-BLxxS, and 2094-XL75S LIM modules wired with the Bulletin 2090 RBM module. The example continues on [page 267](#).

Figure 118 - RBM Wiring Example, Category 3 Configuration per EN954-1

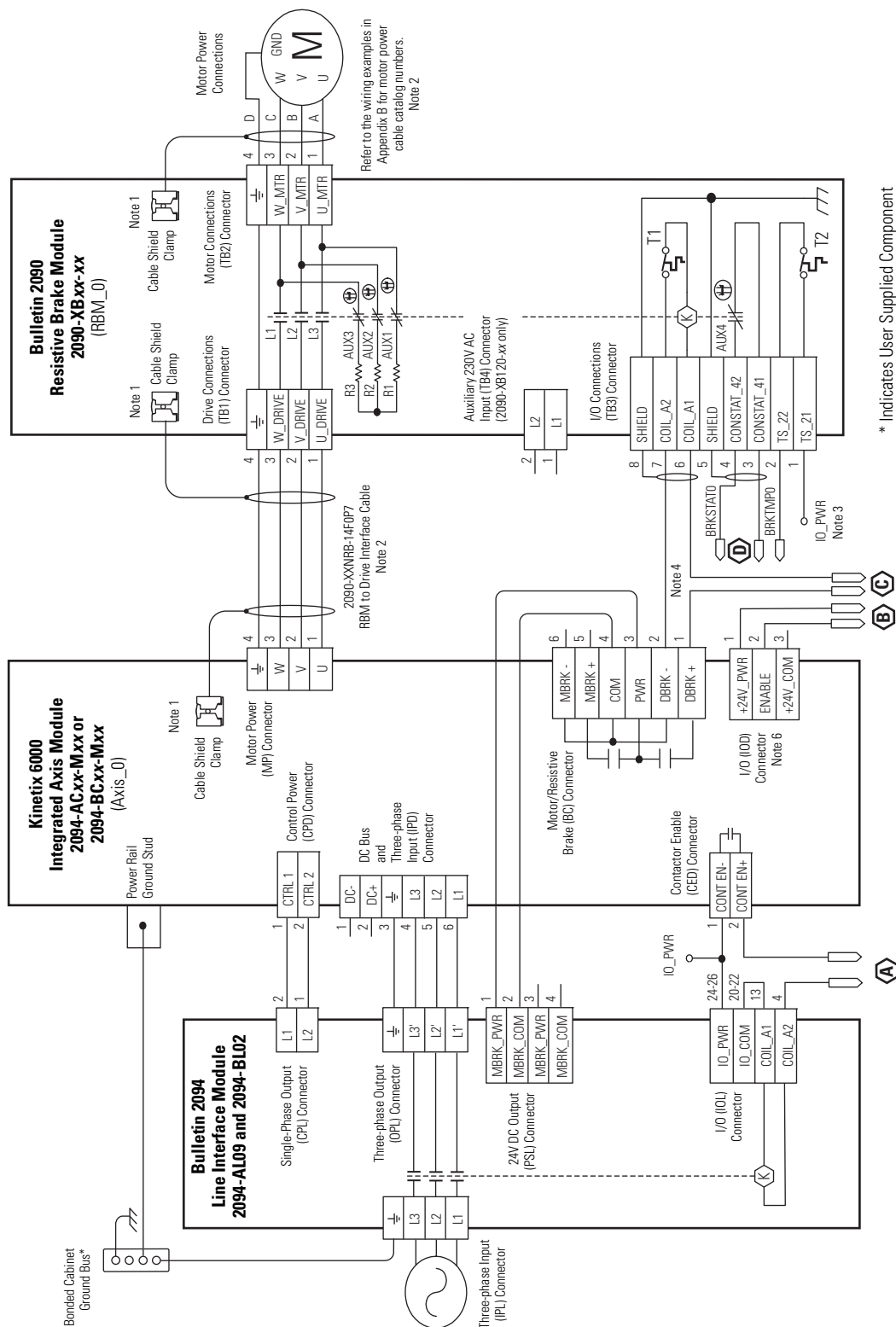


RBM Wiring Example, Category 3 Configuration per EN954-1 (Continued)

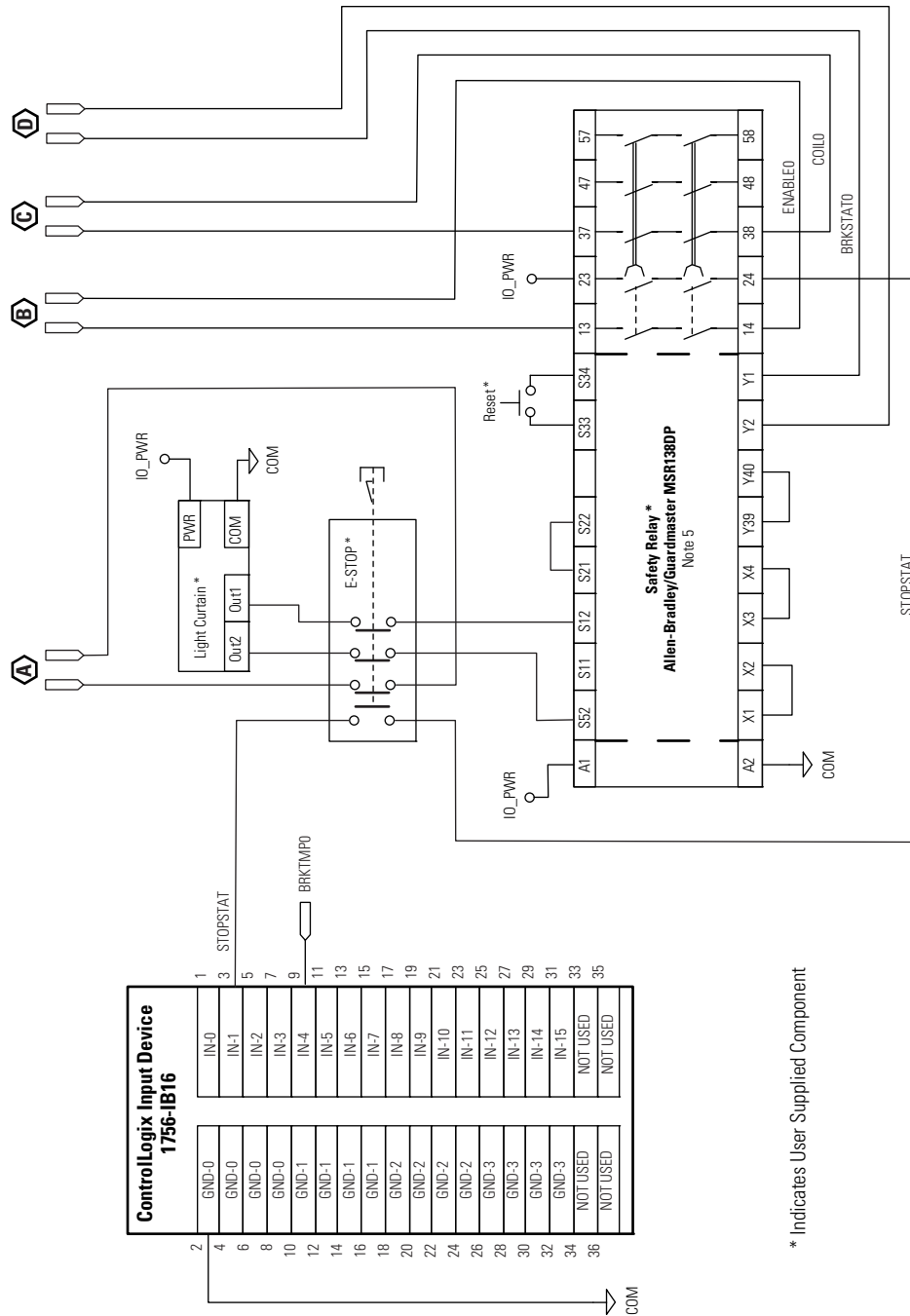


This example diagram shows 2094-*x*Cxx-*M*xx drives (without safe off) and 2094-AL09 and 2094-BL02 LIM modules wired with the Bulletin 2090 RBM module.

Figure 119 - RBM Wiring Example, Category 3 Configuration per EN954-1



RBM Wiring Example, Category 3 Configuration per EN954-1 (Continued)



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